The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XIX. No. 5
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MAY, 1922

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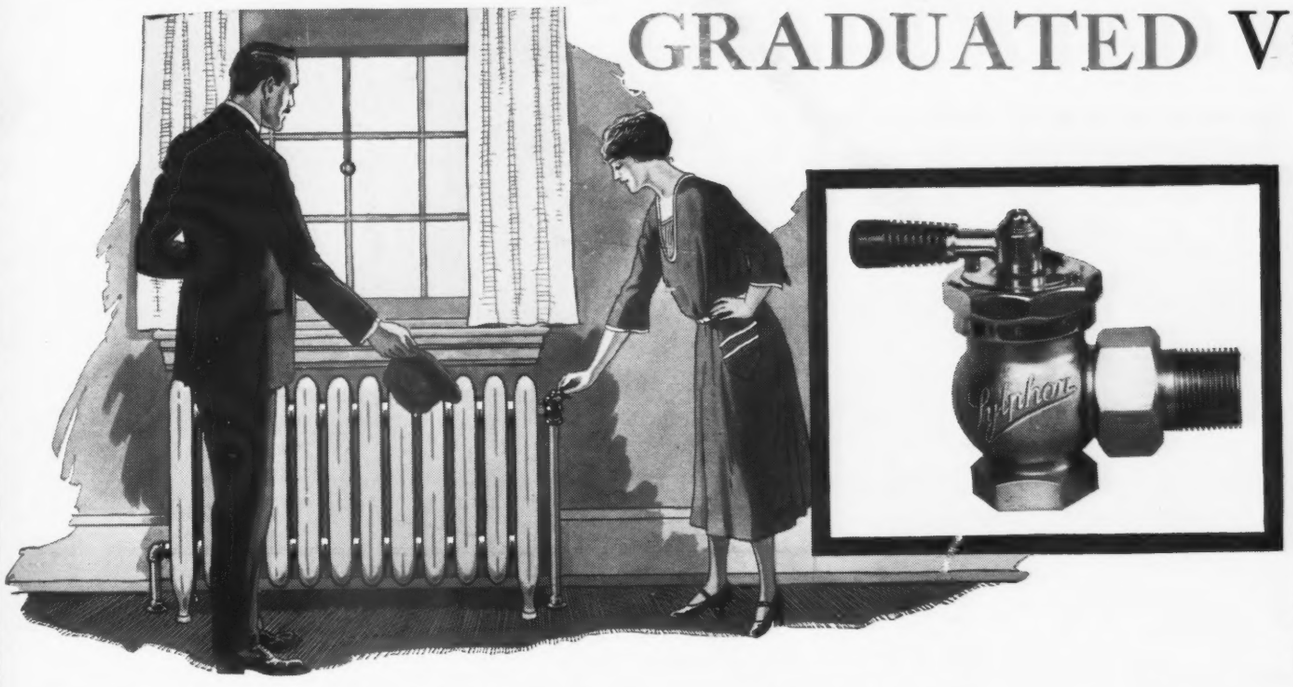
New York Office, 1123 Broadway

Announcing a Sylphon GRADUATED Valve

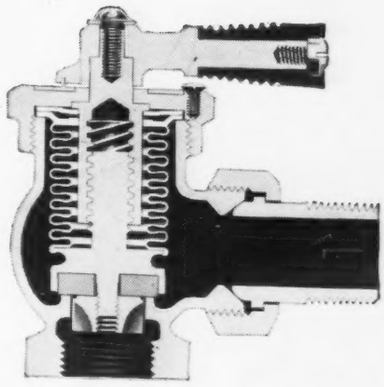


Attractive but rugged; superior workmanship. Stem turns with perfect freedom because it is not exposed to corrosive action of steam. No packing to harden and bind. Quick, easy adjustment of dial to any desired position.

THIS new Sylphon Graduated Valve, packless type, meets an insistent call for a modulating valve as good in appearance, durability and service as Sylphon Packless and Leakless Radiator Valves.

Can be used on vacuum systems, as well as steam or vapor, without possibility of leakage around stem. Opens and closes on a single turn of the handle. Is perfectly tight when closed and can be set to any degree of opening desired. Dial shows amount of opening at all times. Adjustment for opening is made by loosening the two screws in cap nut and turning dial to desired position. Handle is adjusted by removing top screw.

In these valves, as in others of the Sylphon Packless and Leakless type, experience has shown that the laminated Sylphon bellows is much superior to the single-ply structure, and is, therefore, used throughout. **Laminated bellows** are to be found **only** in **Sylphon Valves.**



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The largest plant in the world devoted to the manufacture of thermostatic instruments

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McKINLEY HIGH SCHOOL, CANTON, OHIO

Architect—H. H. Hammond, Cleveland, Ohio

Engineer—Wm. Kingsbury, Cleveland, Ohio

Heating and Vent. Contractors, Huffman-Wolfe Co., Columbus, Ohio

Selected for the Finest School in Canton

NAMED in honor of Canton's most illustrious citizen, the late President, the McKinley High School is easily the most imposing educational edifice in that section of Ohio. In accordance with the general scheme of the architect, engineer and contractors, to make this high school not only most commendable in appearance but a healthful and comfortable place as well, extreme care was taken in the selection of the ventilating equipment.

We are justly proud that, after due consideration, Clarage Kalamazoo Multiblade Fans were chosen. Two large Multiblade Fans located in the basement keep the entire building supplied with fresh, pure air, properly warmed in winter and cool in summer.

It has been our policy, from the very first, to manufacture a reliable product and to render a conscientious service in connection with the application of this product. Technical training and years of practical experience have qualified Clarage engineers to cooperate intelligently with the architect and the heating and ventilating engineer. If you will afford the opportunity, we will clearly demonstrate that our claims for both product and service are not exaggerated. Send for our latest catalog today.

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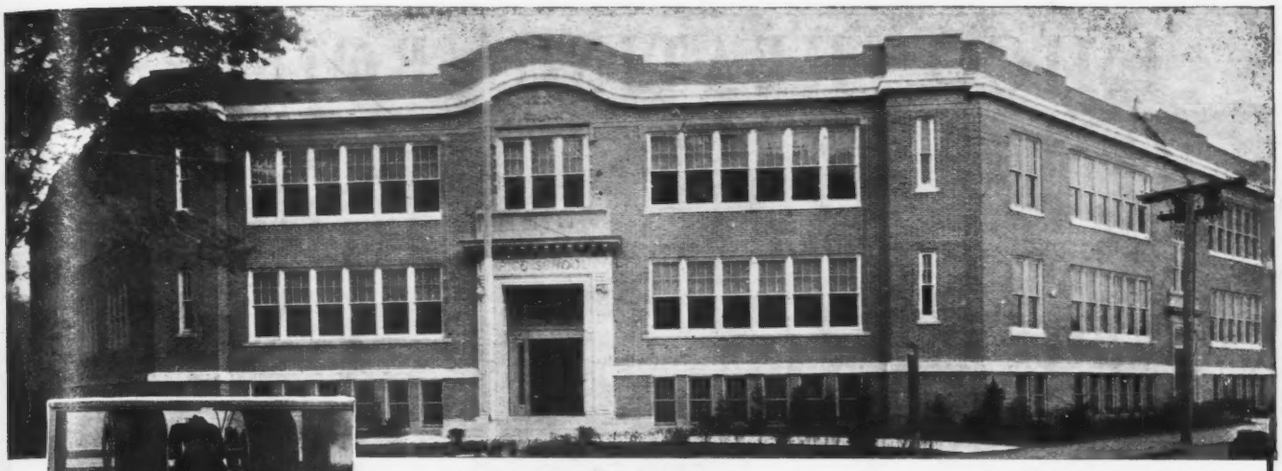
CLARAGE — KALAMAZOO Multiblade Fans



Rice School, Stamford, Conn. *Architects*, Emmons & Abbott

Peerless Unit with front door open showing fans and motor. Front panel and baffle removed, showing special Peerless Vento radiation and humidifying pan.

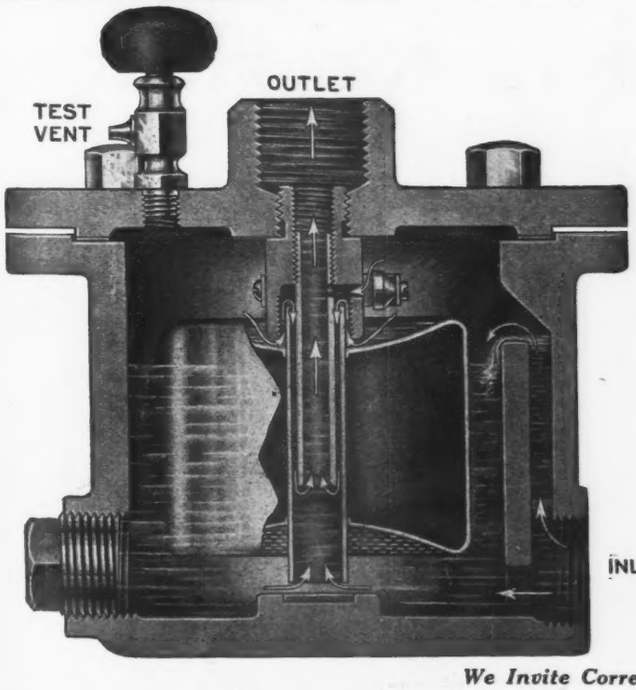
PROPER SCHOOL HEATING AND VENTILATING

THE **Peerless Unit System** of Heating and Ventilating is the ideal system for new or old schools. It is a system founded upon the principle that the heating and ventilating of school rooms be independent of each other; that the control be exact and give room temperature always at the required degree without varying the quantity of air; that both the installation and operation be economical and simple.

A glance at some of the advantages and merits of the **Peerless Unit System** of Heating and Ventilating: adaptable to all steam conditions, whether high pressure, vacuum or gravity heating systems; affords thorough ventilation without drafts; is of noiseless operation and does not require the remodeling of old buildings for installation. Thus the **Peerless Unit *is*** the ideal system for new and old schools.

Ask for our brochure showing typical school installations all over the country.

PEERLESS UNIT VENTILATION CO., Inc., 437 West 16th St., New York



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DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

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"Oil City Boilers" will burn any kind of fuel and are constructed to the requirements of all States and to the Code of Boiler laws as adopted by the American Society of Mechanical Engineers.

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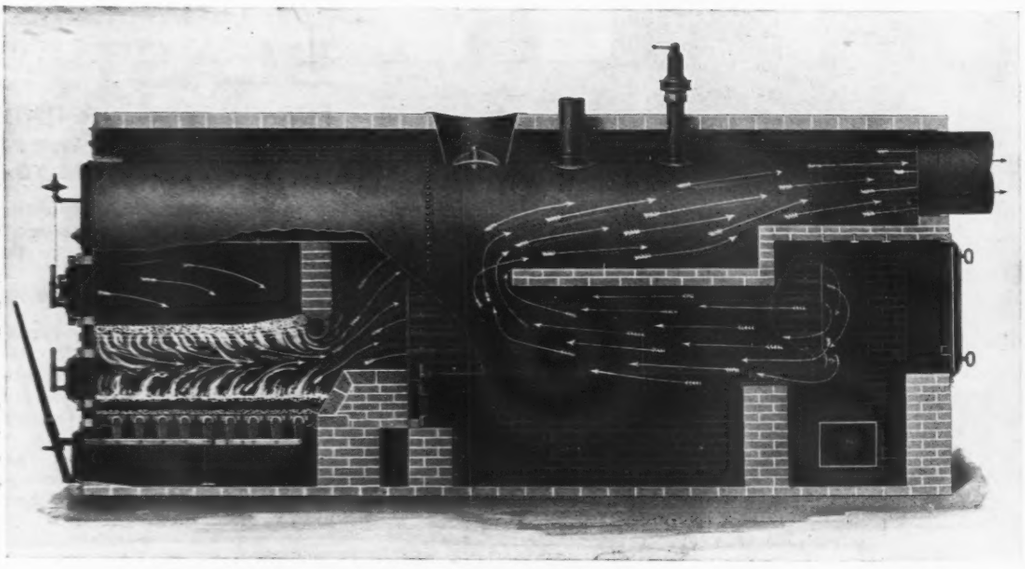
Safety, Efficiency, Economy, Dependability, Durability, No Repairs, Require little attention, Conservatively rated.



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Heats small apartments equally well as the larger ones

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Put your heating problems up to the engineers in our various offices. They will gladly help you.

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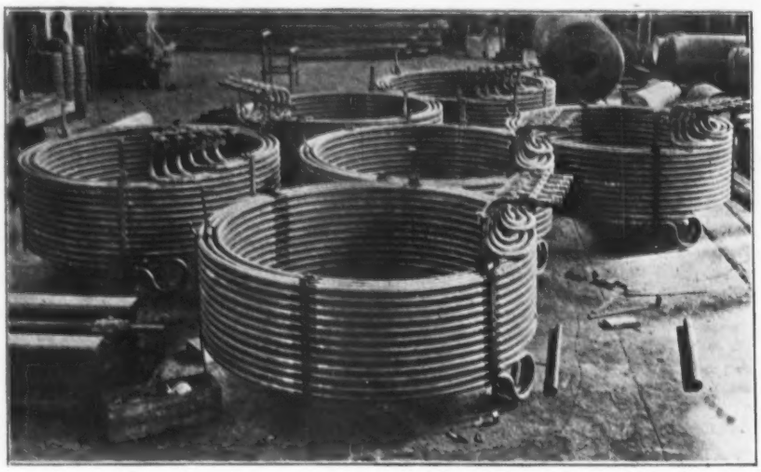
Whitlock Industrial Coils



The Strength of *Whitlock* Coils lies in the weak spot of ordinary coils—the joint. Whitlock Resistance Welding makes the joints stronger than the pipe itself.

Dependable coils of tested tubing for heating or cooling gas as liquid, or condensing gas at any pressure.

Special Bulletins on Request

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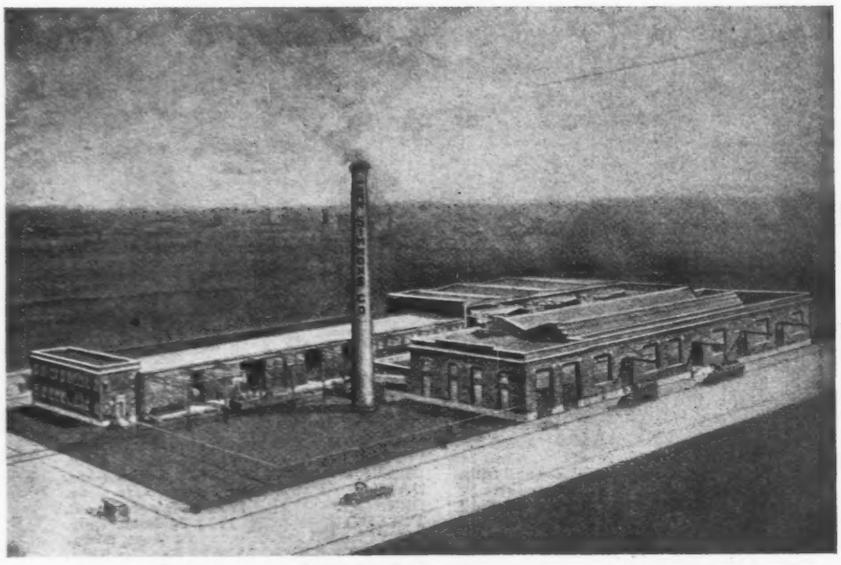

Large stock of STEAM SPECIALTIES

PLUMBING SUPPLIES

PIPE BENDS and COILS made to sketch

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OUR QUEENSBOROUGH PLANT—LONG ISLAND CITY, N. Y.

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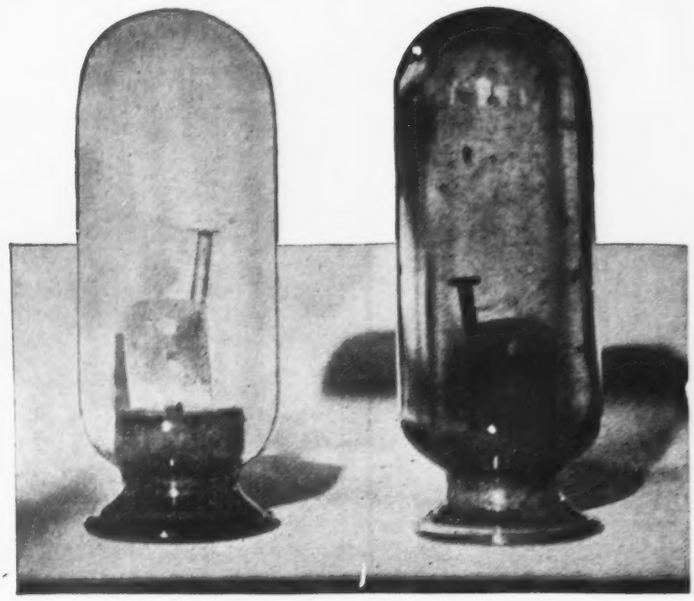
Fabrication Plant and Pipe Warehouses - Long Island City

Which Flows Through Your Pipes?

RUSTLESS WATER is contained in the bottle on the left. The water being free from dissolved oxygen does not corrode the razor blade or nail, and remains as clear as when bottled for an indefinite period.



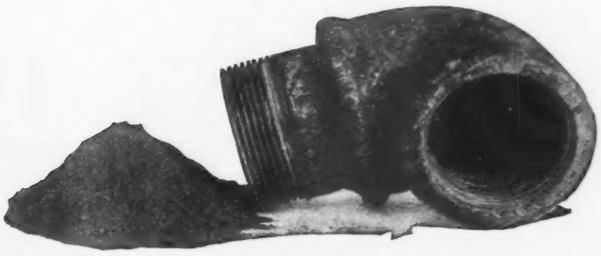
RUSTING WATER fills this bottle,—which is ordinary raw water, containing the normal amount of dissolved oxygen. It quickly rusts the nail and razor blade in the hermetically sealed bottle.

You Can Now Have Rustless (Deaerated) Water

Oxygen dissolved in the water is invariably the principal cause of corrosion, and its elimination extends the life of pipes indefinitely.

A practical method for removing the oxygen and other dissolved gases from the water before it enters your piping system has been perfected. This method is the Elliott Deaeration Process and it accomplishes the removal of dissolved gases in a thoroughly scientific manner.

It is now possible to install iron or steel pipe in your building with the assurance that you have no corrosion to fear, thus extending the life of the pipe several times. An Elliott Deaerator can be installed in your present building, and will check rusting away and corrosion of the hot water piping, and work out of the system corrosion products now contained therein.



This pile of rust scale removed from the elbow and nipple indicates that corrosion products can cause serious stoppage of pipes.

The Elliott Deaeration Process is simple. Heated water is suddenly injected and distributed into a region of vacuum. The water boils explosively and the dissolved gases are liberated. Oxygen removal can be obtained beyond the limit of determination. At least 97 percent of the oxygen contained in normal water should be extracted before hot water piping is safe from attack by corrosion, and the Elliott Deaeration Process is the only known method to accomplish this.

Our booklet "Corrosion—Its Cause and Cure" will be of interest to you. It will be sent on request. We will be glad to explain fully this practical piping insurance in the obtaining of rustless water.

N-758

Condensers
Air Ejectors
Deaerators
Twin Strainers
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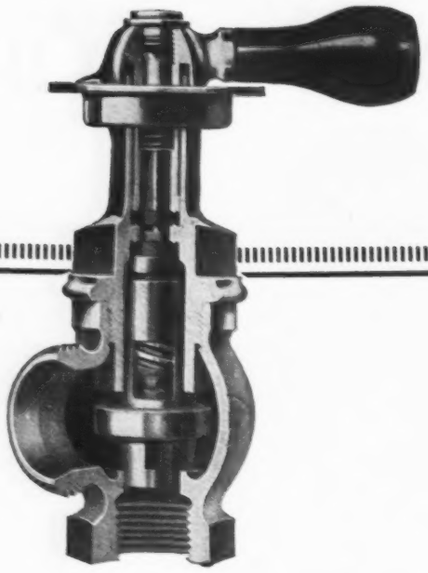

Your Jobs Deserve Them

The entire heating installation—your most careful planning and best materials—is all at the mercy of the radiator valves, for if they fail to work, the radiators cannot function properly and the whole system is a failure.

LAVIGNE

PACKLESS STEAM RADIATOR VALVES

are dependable, never failing in service for they are made with a realization of their important duty. The proven design and simple construction, with the fine, careful workmanship with which every part is manufactured make them leakless, quick opening, never-sticking and they regulate the steam flow perfectly.

Made in Angle, Globe, Right or Left-hand Corner styles; furnished with Round Wheel or Plain Lever Handle, Graduated Dial with Lever Handle or Round Wheel, Extension type with Lever Handle or Round Wheel, also Lock Shield, either Plain or Graduated. The complete range of styles and sizes satisfies every requirement for Vapor, Vacuum, Central Station or Low Pressure Steam Heating Systems.

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LAVIGNE

Simplest, Quickest and Most Durable

Ask any of the plants using the American Dead-Weight Gauge Tester—they'll tell you it's the simplest, handiest and quickest-and-easiest-to-use tester on the market. You can test three or four gauges with the American Dead-Weight Tester while testing one with most others. It will hold the pressure at any point as long as desired, thus insuring absolute accuracy in comparing the reading of the gauge at all points on the dial.

AMERICAN
DEAD WEIGHT GAUGE TESTER

is completely self-contained. Auxiliary chamber carries the oil for forcing into gauge tubes, with a simple action for drawing it back again after each test. No spilling or waste of oil, no waste of time, no muss or fuss.

In addition to their absolute accuracy and their greater convenience, American Dead-Weight Testers have the big advantage of considerably less bulk and weight to carry around.

Moreover, their simplicity and rugged construction mean much longer life.

Made in various sizes for pressures from 5 lbs. Up to 1000 lbs. Other equally efficient types for higher pressures.
Don't buy any tester without at least having the facts about the American. Send for descriptive Circular.

American Steam Gauge & Valve Mfg. Co.

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STANDARD—MEDIUM
EXTRA HEAVY—HYDRAULIC

BRASS GATE VALVES

are made in sizes and designs adaptable to all pressures, and may be relied upon to give dependable service for any purpose requiring valves of this type.

They are tested under steam pressure before leaving the factory.

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ECONOMY BOILERS

"The boilers that burn the gases as well as the coal"

Sectional Types

Rated at 700 to 9900 sq. ft. direct steam radiation, corresponding sizes for hot water.

No Change in Ratings

The ratings assigned to Economy Boilers when they were first introduced to the trade have not been changed.

Economy Boilers are conservatively rated, and will, under proper conditions, carry the amount of radiation assigned. Conditions vary, however, and before any size or type of boiler is selected the particular situation under which it will be installed should be carefully analyzed and *the boiler suited to the job.*

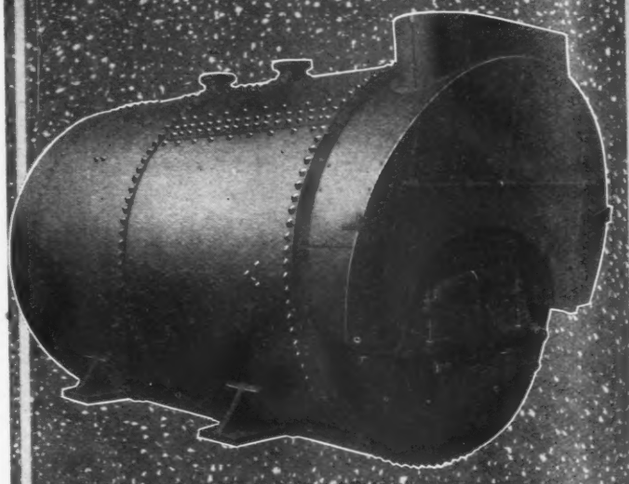
If you are interested in knowing the method by which Economy ratings are determined and want some real help on selecting the right boiler for each installation, send for new catalog 1296-H. Or we will arrange to have our representative call and present some facts on *suiting the boiler to the job,* which will prove beneficial as well as interesting.

INTERNATIONAL HEATER COMPANY
UTICA, N. Y.

BRANCHES:

New York Chicago Cleveland Nashua, N. H.

STANDARD INTERNAL FIRED SCOTCH TYPE BOILERS



Each member of the TITUSVILLE Boiler family has a definite individuality peculiarly adapted for one purpose. Which member of this vast family should you use for that important project you have in mind? Don't guess—Let the TITUSVILLE IRON WORKS be your authority.

This illustration shows a Standard Internal Fired Scotch Type of Boiler built to 100 lbs. working pressure—A. S. M. E. code—30 to 100 H. P. This boiler is of the dry back style entirely self contained and of the most compact type made.

The Continental Type of Scotch Boiler with corrugated furnace is made in sizes from 75 to 250 H. P. for working pressure up to 200 lbs.

For further information and specifications, see our latest catalog now ready for distribution.

THE TITUSVILLE IRON WORKS CO.
Titusville, Penna.

At Last!

A SINGLE PIPE VAPOR SYSTEM

Simple to install
Efficient in operation
Low in cost

Descriptive matter sent on request

GORTON & LIDGERWOOD CO.

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FISHER BUILDING, CHICAGO, ILL.

Climate
Manufactured to suit your Product

Even Temperature and Constant Humidity Over the Entire Department

AND the method of doing this is by introducing, by the Sturtevant-Fleisher System "prepared" air, into the Departments at just the right temperature and containing the required percentage of relative humidity.

There is no guess work and no manipulating of spray heads or ventilators necessary. The action is automatic and requires little or no attention—

The Results?

The results are guaranteed. Each system must operate to do the work for which it is designed. If it does not, we will make such changes—at our own expense—as we think necessary. If it still fails to perform as guaranteed, we will remove it at our own expense. No charge will be made for installation, and all moneys paid will be refunded.

Such a Guarantee as this is written into every Sturtevant-Fleisher Contract, whether it is requested or not.

Don't you want the security of such a Guarantee?

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Design and install all Sturtevant-Fleisher Air Conditioning Systems

Sturtevant
PUTS AIR TO WORK

IDEAL AIR CONDITIONS FOR THE NATION'S CAPITOL

A 25-unit Oxone Pure Arifier that on the basis of 10c per kw. hr. will run 10 hrs. at the cost of 12c ozonizing 25000 cu. ft. of air per minute.

Two Ozone Pure Arifier equipments, 100 cylinder units of the type shown here, are successfully operating in our Capitol in connection with the mechanical ventilating system.

These units ozonize 40,000 cu. ft. of air per minute for the Senate and 60.000 cu. ft. of air per minute for the House of Representatives, giving our legislators a pure, fresh and invigorating atmosphere in which to conduct the affairs of the nation.

Ozonization is the latest scientific method of insuring fresh air and the Ozone Pure Arifier is the latest scientific device. These arifiers are made in any size desired to meet exact requirements, and from the Nation's Capitol to the Home, the Ozone Pure Arifier is daily affording healthful ventilation, efficiently, scientifically and economically.

Our latest bulletin entitled "Nature at Her Best" will give you some very interesting facts about Ozone that you as an Architect, Engineer or Contractor should be familiar with. Send for it.

OZONE PURE ARIFIER COMPANY
1455-1457 West Congress Street Chicago, Illinois

"O-E Perfect Packless Graduated Valve. Placed at top of Radiator. Quick opening. Never sticks. Tested by Air and Water tests.

Simplicity in a Heating System Is Twin Brother to Common Sense

The basic principle of the "O-E" Perfect Vapor-Vacuum-Pressure Heating System is simplicity. There are no floats, return traps, pumps, diaphragms or other complicated parts to get out of order. Eliminates automatic air valves.

Three Systems in One

Vacuum most of the time, Vapor part of the time, Pressure when desired. A great coal-saver. Always holds steady water line. Most adaptable, flexible and efficient of any. Noiseless in operation. Practically fool-proof. No expert attention needed.

"O-E" Perfect Air Exhauster and Vacuum Valve, with new Hollow Bronze Ball. Always works. Never sticks. Carefully tested.

The "O-E" System costs less to install and gives your customer better service than either vapor or water. Is easier to install right than wrong.

Before deciding on the heating equipment for your next job, investigate the "O-E" Perfect System. It will save you labor and material costs, unprofitable call-backs for adjustments and repairs, and our guarantee furnished with each installation fully protects you

"O-E" Perfect Ball Check Water Seal Return Fitting, with Air Vent and Clean Out. Each Fitting carefully tested.

Write for Booklet "A"

O-E SPECIALITY MANUFACTURING CO.

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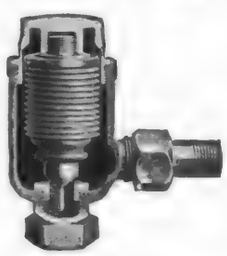
QUALITY SERVICE QUALITY

Heating Specialties that Last

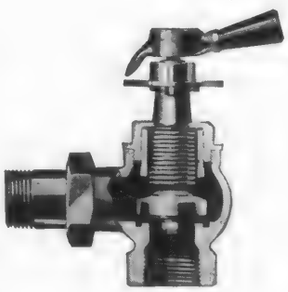


The B & B Line

In specifying the B. & B. Line of Heating Specialties for vacuum systems and Temperature Control Systems you are assured of getting QUALITY-SERVICE and a Heating Specialty that will last.

The B. & B. Multiflex Trap and B. & B. Multiflex Modulation Valve, as illustrated, are metal throughout and contain a B. & B. Multiflex Wonder Bellows. Note the simplicity in construction of the Multiflex Modulation Valve.

Literature sent upon request.



B. & B. Vacu-Vapor System

B. & B. Return Line System

B. & B. Air Line System

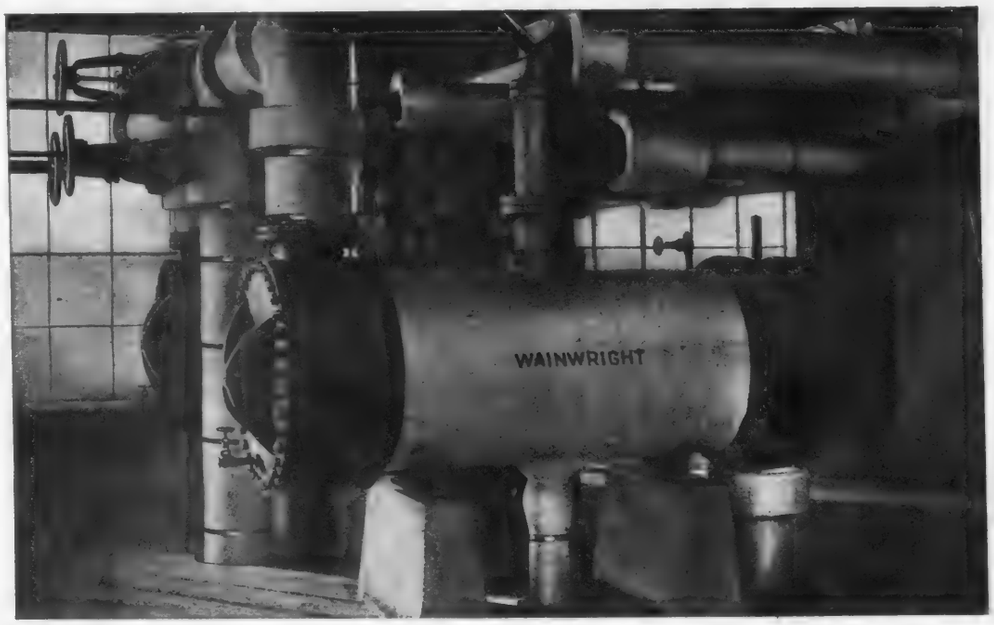
B. & B. Temperature Control System

B. & B. High Pressure Specialties

THE BISHOP & BABCOCK COMPANY

General Offices and Factories, CLEVELAND, OHIO

HEATING SYSTEM HEATERS



ALBERGER PUMP & CONDENSER COMPANY

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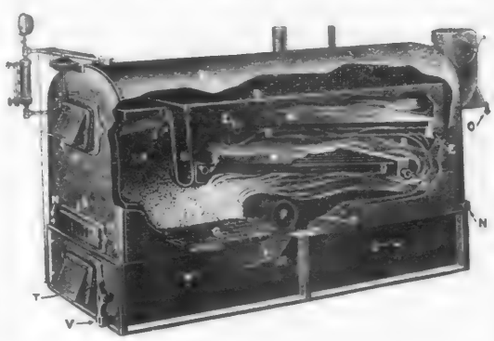
INVESTIGATE THE LATEST HERBERT MAGAZINE WATER TUBE SMOKELESS BOILER



1—No smoke after the fire is thoroughly started.
2—No Flues to clean.
3—Burns Soft Coal Successfully.
4—Carries steam from twelve to fifteen hours with one fire.
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6—It is all shell surface, which means economy.
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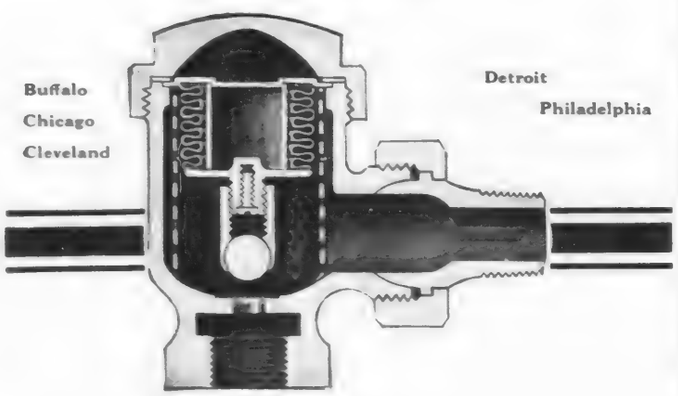

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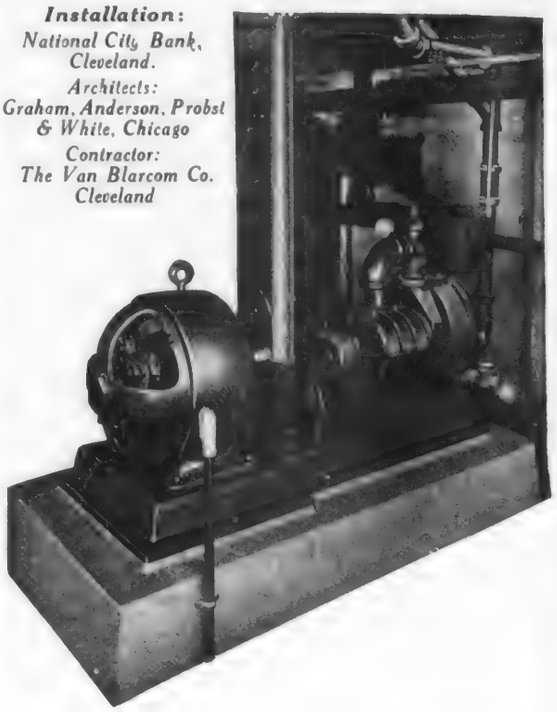

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Trane's giant Float Vent is shown here in section. Proportions are exact to the most minute detail. Note the extreme simplicity of construction, and contrast with the ruggedness of every part. Note, too, that this vent uses no diaphragm, no liquids; instead, there is the effective Trane Thermetal (all metal) member. This is the same element that has made the Trane Thermetal Radiator Trap ("The Trap Without a Diaphragm") famous. Equipped with highly efficient vacuum check, visible directly below valve cap.

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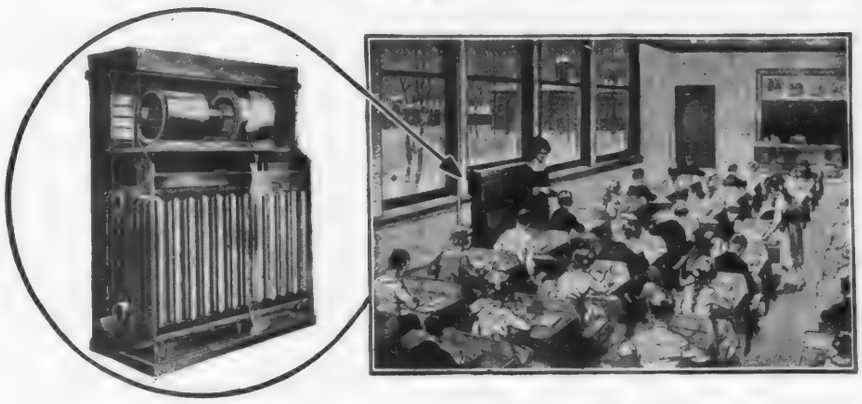

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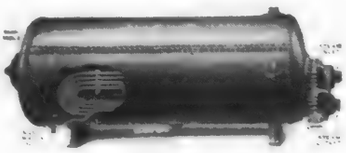

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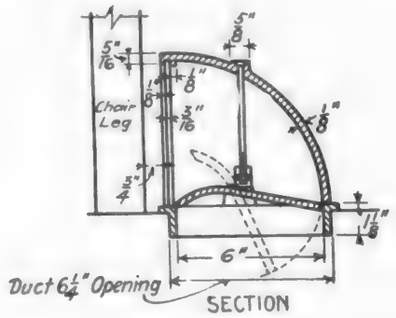

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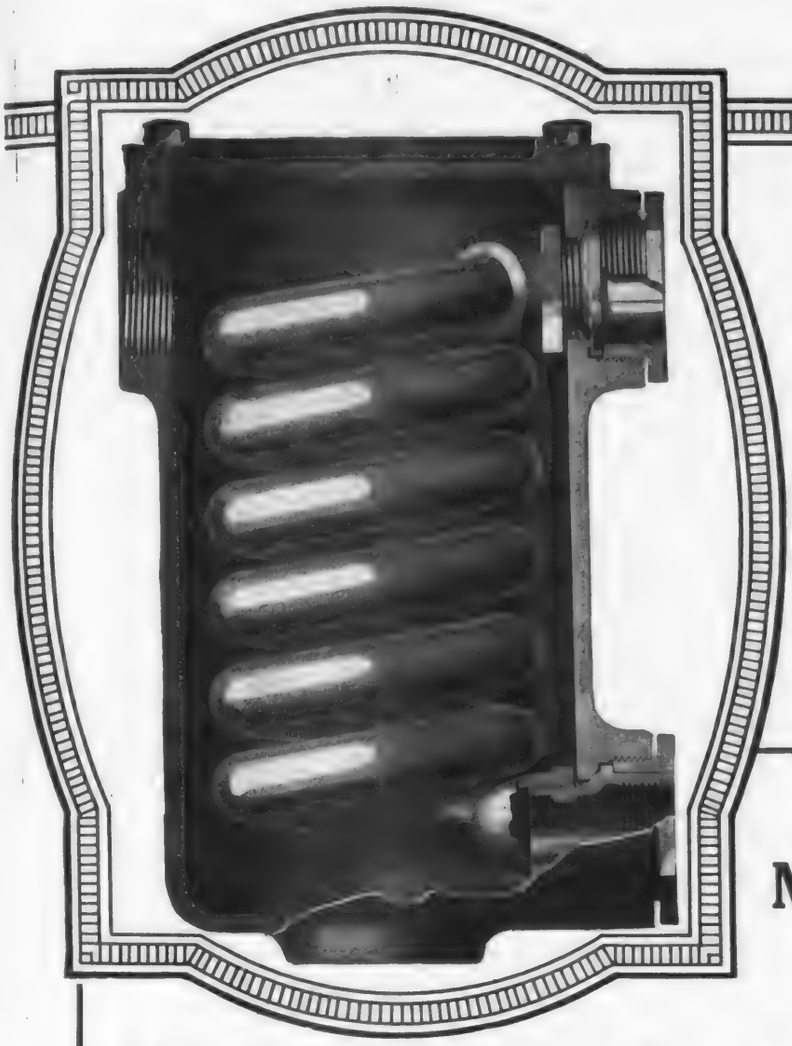
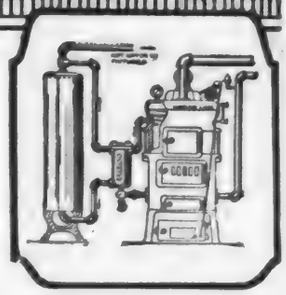
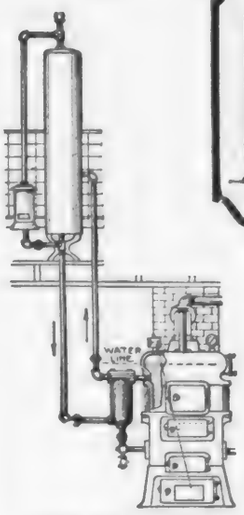




Tank in Basement



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Diameter of Pipe	Air Displacement Cu. Ft. per Hour	
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8 Inches	17,300	21,600
10 "	26,500	32,500
12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
30 "	225,000	272,000
36 "	281,000	330,000
42 "	324,000	414,000
48 "	360,000	473,000

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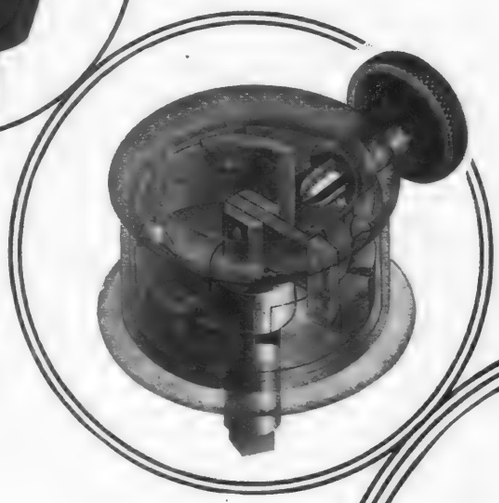
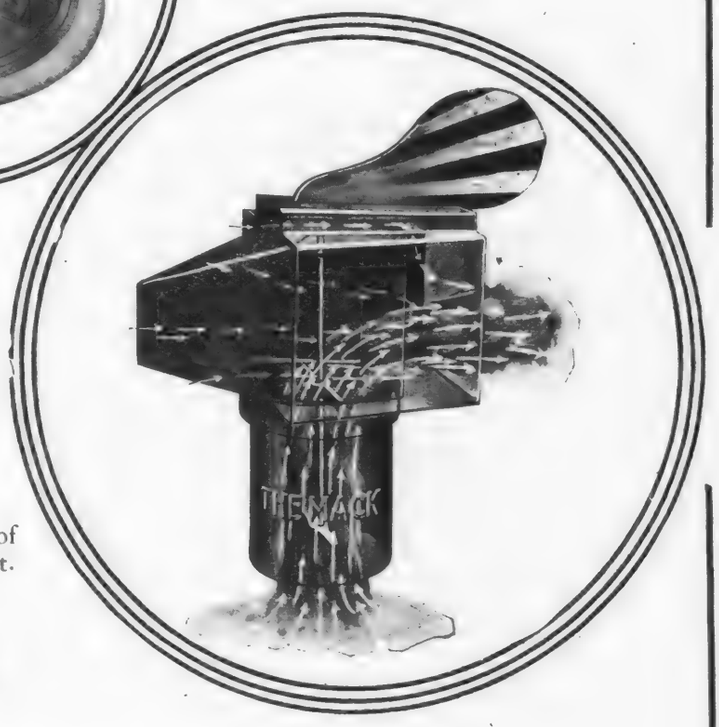


2. The Perfecto. A combined damper-lock, regulator and indicator. Regulates and controls incoming temp-ered air and exhaust of vitiated air. Locks that control. Indicates position of damper. Designates rooms to which ducts are directed. Made of stamped steel, any desired finish.



3. Mack Ejector. "A ventilator that uses its head," always operative, utilizing low velocity wind pressure. Inverted bronze bushing working in steel bearing, and individual balancing, assure silent ease of motion and positively prevent down-draft. Substantially built and all edges are wired.

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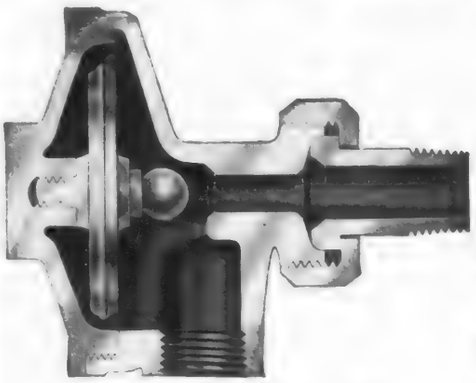

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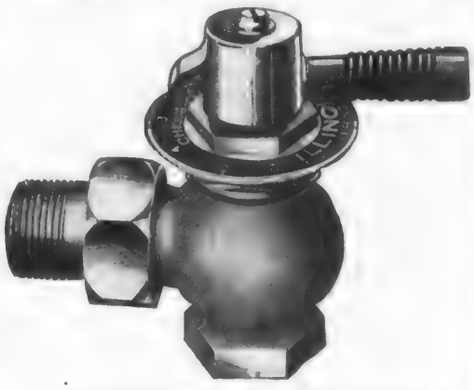

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All working parts accurately machined.
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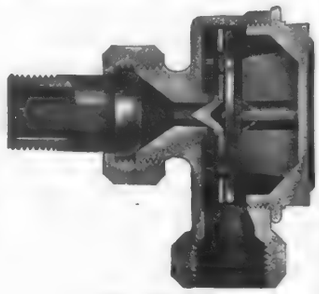

No. 28 Trap

McALEAR MFG. CO.
CHICAGO

The Heating and Ventilating Magazine

VOL. XIX. NO. 5

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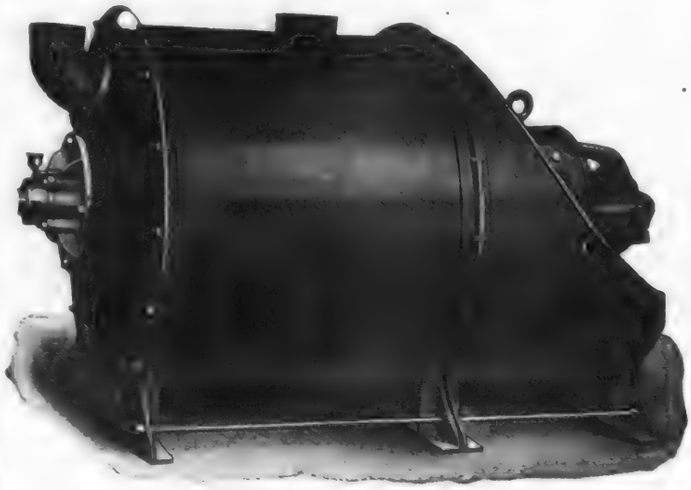
Send for list of references of school installations and complete data regarding the Spencer equipment.

Spencer Turbine

Cleaning Systems



Horizontal slow speed Spencer Turbine vacuum cleaning exhauster. Direct motor driven, wide clearance, multistage type equipment.

particularly developed for the cleaning of school buildings in a sanitary manner without spreading dust in the air, and giving the most thorough and rapid cleaning for school buildings.

Spencer systems are chosen by those who have had the most experience with vacuum cleaning apparatus in school buildings.

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Thirty-seven years ago The Johnson Pneumatic System of Temperature Regulation was placed on the market. It was the first successful method of complete temperature control: the introduction of a utility that has proved of infinite benefit to the world and man-kind. And during these thirty-seven years every improvement in temperature control apparatus and its installation has had its origin with The Johnson Service Company: the pace maker in the progress of the industry, as well as the pioneer. Thus this company leads.

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

MAY, 1922

EFFECT OF CONSTRUCTION ON HEAT LOSSES FROM BUILDINGS

What it Means to Have Walls and Windows Well Built, and to Have Air Spacing Between Walls

BY S. HOMER WOODBRIDGE.

II.

DOUBLE sashing protects against heat loss in two ways; first, in reducing the transmission rate through windows; and, second, in reducing the amount of inleakage of outside air about and through sashes, if the setting of glass in sashes is loose.

Double glazing is principally effective through reducing the heat transmission rate. It in no way affects the rate of air leakage about window sashes or frames. If panes are loosely set in sashes, double glazing reduces air leakage due to that cause. In the reduction of transmission rates alone, double glazing is of larger value than double sashing because of the closer proximity of the panes, and the consequent retardation of convection currents between them.

Comparative Advantages of Double Sashing and Double Glazing.

For the reasons given, double sashing is therefore most useful on those sides of a building most exposed to cold winds. Double glazing, on the other hand, is equally effective on all sides of a building. Though the outer sash of a double window may be as leaky as are the inner sashes, the outer sash is yet a protection against the inleakage of outside air.

Air flow through an orifice, of any form or size whatsoever, is the result of unbalanced pressure. If any given pressure produces a flow 100 through a single orifice of any given size, it will not, because it cannot, produce the same volume of flow, 100, through two successive orifices of the same size. That given pressure cannot produce the same velocity of flow through two successive apertures as it can and will produce through a single aperature.

Because of the considerable space between sashes, the air passing through orifices in or about the outer sash comes to a state of comparative rest before approaching and entering an orifice existing in or about the inner sash. If two orifices are of the same size and form, the volume of air passing through the two in succession under a given pressure will be, approximately 7/10 of the volume of air which would pass through a single aperture under the same pressure. Therefore though the outer be as leaky as the inner sash, the gain by using the outer sash, in the matter of leakage alone, is 30%.

For the purpose of computing and comparing the economic values of double glazing and double sashing, let us suppose the glass used to be of such quality and thickness, and to be so set, that the thermal transmission rate per hour through a single thickness of glass equals 1 B. T. U. per square foot for each degree F. of temperature difference between inside and outside air. Let the effect of double glazing be to reduce that rate to 0.76 B. T. U. In the case of the residence above cited let the aggregate area of windows be 1270 sq. ft.

The annual saving possible through the use of that amount of double glazing may be computed as follows: 1270x0.24x35x-24x240=37,447,780 B. T. U., equivalent to 2.35 tons of coal, which, at a cost of $10.00 a ton, equals $23.50. If the cost of double glazing be $0.25 per square foot, or $317.00 for the entire building, the interest cost at 6% becomes $19.02, and the economic gain negligible.

Hygienic Value of Double Glazing.

The principal, and often the quite sufficient gain in the use of double glazing is hygienic, rather than financial. That gain is in the more comfortable conditions obtainable, and maintainable, within a building because of reduction in the volume, and increase in the temperature, of air moving floorward from the windows, and consequently warmer floors and a perceptible lessening of heat loss from the occupants by radiation to the glass of windows. In zero weather the thin glass of single-glazed windows becomes little better, and frequently worse, than so much ice surface at 32° exposed to the occupants of the room. The effect of double glazing is to raise the tempearture of the inner glass as such a time to approximately 50°, and to greatly mitigate the severity of the draft and temperature conditions which obtain when glazing is single.

From the housekeeping standpoint, the double glazing is open to the objection that the inner surfaces of the panes are inaccessible for cleaning. They are so equally inaccessible to atmospheric and other dirt, even in minute dust form, that, if well puttied in place, those surfaces have shown no evidence of cloud or tarnish in cases where they have been in continuous use for a score or more of years.

Extra Protection Afforded by Double Sashing.

As already noted, double sashing affords double protection against thermal loss; first, by reducing the transmission rate, and, second, by lowering the air leakage rate, due to both gravity and wind actions. The economic value of double sashing is governed by the tightness of the sashing in itself, and in its placing, in the percentage of window space covered, and, to some degree, by the distance between the inner and the outer sashes. Such sashing is seldom made to cover the entire window aperture, including window frames, and crevices between the frames and the wall in which they are set. They commonly cover only the sashes, and protect according to tightness against the intra and inter-sash airways and crevices between sashes and panes.

The economic value of double sashing may be computed in this manner; let 1000 sq. ft. of single glass be exposed, on the north and west sides of a building, to weather conditions which during the heating season, totalling 240 days, include 80 days of wind of the usual seasonal average intensity out of the north or west: let the quality of single glass as to thickness, size and setting of panes, and the fitting of sashes in their frames, be such that the heat loss by transmission is 1 B. T. U. per hour per square foot of window area for 1° difference of temperature between the inside and the outside air. Let it be further assumed that the loss by leakage through and about the window sashes equals that by transmission through the glass when there is no wind, and that the loss by leakage doubles that by transmission in times of average wind. If the average difference of temperature during the "closed season" is 35°, the heat loss for the entire season through 1000 sq. ft. of single-glazed windows, as found by computation, is 403,200,000 B. T. U. Let the wind effect for 80 days double the rate of heat loss through the windows in question; the total loss for the season then becomes 547,600,000 B. T. U.

Let the outside sashing be of such type and tightness of setting that the transmission loss becomes 75% of that with single glass, and the leakage rate 60%. The mean effect of double sashing is then to reduce the sum of the rates of loss to 67½% of that existing under single glass. The saving effected is therefore 32½% of 547,600,000 B. T. U. or 177,970,000 B. T. U. per year. Since the available thermal value of a (short) ton of coal as burned for domestic heating averages about 16,000,000 B. T. U., the coal equivalent of the saving found becomes 11-12 100 tons, and the money equivalent, at $10.00 per ton, $111.20.

Offsetting such gross saving are such items as the interest on the investment, the depreciation of the material, the cost of keeping the same in repair, and of placing, removing and storing, and of cleaning the large and fragile sashes; representing a total of not less than $60.00 per annum, making the probable net profit approximately $50.00 or $0.05 per year per square foot of double glazing.

Hygienic Features of Double Sashing.

Here again, the hygienic gains exceed the monetary profit. The chilling down-draft over cold single windows, due to downward convection currents over the glass, are commonly mistaken for cold indraft through the window. With double sashing, these become relatively negligible. When to chilling down-draft is added the radiation effect from an occupant in the near vicinity of an unprotected window, the double effect is often pronounced enough to become a disturber of comfort, a menace to health and a cause of expense through illness, medical attendance and nursing, which may easily far exceed that of the protecting means employed.

Because the menace increases in a ratio greater than that of the fall in the temperature of the window glass, and more nearly in geometric than arithmetic ratio, the raising of such air temperature of 15° to 18°, and the further reduction of that air volume by 30% or 40%, because of reduced chill and lessened inleakage, contributes appreciably to the comfort and the safety of near window occupants in rooms having cold exposures.

Weather Strips as Wind Stops.

Passing notice only can be given to the economic effect of the use of the better forms of weather strips, storm-doors, and of similar devices frequently used for preventing or lessening air leakage. Window and door weather strips of the best type, when properly applied, may be made quite as effective as double-sashing as wind stops. If without their use window sashes are loose in the setting, they may so decrease indraft as to diminish chill caused by window leakage from 20% to 30%. They have no effect on transmission rates, and in this respect they are not comparable to either double-glazing or double-sashing or double-dooring.

Outward Air Leakage.

As commonly constructed, the upper part of a building, including the roof, is more open to air movement than is the lower part of such structure, including the basement and cellar floor. Floors, ceilings and walls of rooms are like fine-meshed sieves to the passage of atmospheric molecules. Upon a cold still day or night, open a basement window, and, with all designed airways connecting the basement with the warmed floors above tight closed, note the large volume of steadily inflowing air.

Through church and hall auditorium ceilings and roofs the outward leakage in cold weather, and with a warmed interior, is often quite enough to provide all exit ventilation needed for a crowded floor. The writer occupying a room in which the windows were tight closed, and the floor covered with an ingrain carpet upon which were a couple of good-sized and heavy-braided rag rugs, and which was directly over a similar room with door closed and windows open to windward, has seen the carpet of his room rise and fall through one or two inches in rhythmic action with the gusts of wind on a breezy day, as they beat upon the house. That wind entering the open windows of the room below produced within that room a plenum condition in pressure corresponding to $\frac{V}{\sqrt{29}}$ where V is the per second velocity of the outside wind.

That pressure within the room below forced air through the plaster of the ceiling, of the papered walls, and through the crevices of the floor of that room, and that leakage, finding open channels in the under floor spaces and intra wall furrings, travelled to the floor spaces beneath the occupant's room, and passed through the cracks of that floor more rapidly than it could escape through the meshes of the open weave of the carpet. The door of the occupant's room was open into the hallway and no pressure due to wind action was present within it.

Instance Where Roof of House Was Sealed by Frozen Slush

To cite another instance of personal experience. A frame house 35 ft. x 40 ft. x 30 ft. had a gable roof. The roof was on one occasion covered with a heavy fall of light snow; the outside temperature fell close to zero; the wind was light; comfortable warming was possible only as the fire was forced. A subsequent thaw and rain was followed by a sudden and sharp fall of temperature to the zero point. The roof snow first reduced to semi slush, then quickly froze solid and tightly sealed the roof. The house was then easily and evenly warmed, not only without any forcing of fire, but with a surprisingly low rate of fuel burning.

The stoppage of the upward and outward movement of air through and from buildings makes necessary special and careful construction. To effect such stoppage, it becomes necessary to practically seal either the roof or the attic floor, or else the entire ceiling beneath that floor, against air filtration movement, and also to close all vertical studding spaces between the plaster and outer walls, and in all inter wall con-

struction. The eel grass quilting, heretofore described, with its double thickness of close paper, has been found effective for such purpose, adding good insulation to partial imperviousness. Sackett's board, or other close-pressed fibre board, may be similarly employed.

The more surely a building is sealed against spontaneous ventilation, the less heat quantity is required to properly warm it, and the greater becomes the need of providing artificial means for the ventilation of buildings for habitation purposes. Regard for economy in fuel must never be allowed to trespass on the paramount economy in matters of health.

In a subsequent paper Professor Woodbridge will discuss "Heating Equipment and Methods of Heating in Their Relation to Heat Losses," with special reference to the economies obtainable and the wastes avoidable in the warming of buildings.

RESEARCH WORK THAT SOLVED THE PROBLEM OF VENTILATING THE HUDSON RIVER TUNNEL

Results of Four Series of Tests to Determine the Amount and Effect of Automobile Exhaust Gases in the New York-New Jersey Vehicular Tube

EDITOR'S NOTE.—*Engineers who have followed the development of tunnel ventilation in general and that of the Hudson River vehicular tunnel in particular will be interested in the accompanying account of the tests which have been made to determine the air requirements for underground tubes containing hundreds of moving automobiles. We are indebted to Compressed Air Magazine for the accompanying presentation by Robert G. Skerrett, which appeared in its issue for April, 1922. The article will be found to supplement very nicely the previous reports on this subject which appeared in* THE HEATING AND VENTILATING MAGAZINE *for April, 1918 ("The Proposed New York-New Jersey Vehicular Tunnel"); for May, 1921 ("Method Adopted for Ventilating the New York-New Jersey Vehicular Tunnel"); and for December, 1921 ("Bureau of Mines Experimental Tunnel for Studying the Removal of Automotive Exhaust Gas," by A. C. Fieldner and J. W. Paul).*

TO ventilate the twin tubes of the Hudson River vehicular tunnel by blowing fresh air through the viaduct from end to end, forcing the air in at one portal and allowing it to escape at the other, would require a very large volume of circulating air and would entail excessive air velocities along the roadways, especially at points near the supply nozzles. Modifications of this system, in which shafts were to be utilized to shorten the distance between the intake and the exhaust portals, were considered, but this arrangement in itself, was found unsuited and not likely to radically better conditions.

Finally, after considerable deliberation, the engineers of the commission settled broadly upon a scheme which would introduce fresh air into each tube through a number of openings leading from a supply duct—this passage to be separated from the roadway, and carry off the tainted air by another duct of a kindred character. This disposition of ducts promised to avoid excessive air velocities and likewise to insure throughout the length of each tube a uniform distribution of fresh air and a corresponding withdrawal of the atmosphere admixed with hurtful gases.

Certain experiments made in 1916 seemed to indicate that it would probably be advisable to place the fresh-air duct below the roadway and the exhaust duct above the ceiling, and this arrangement was tentatively agreed upon until further tests could be made to settle this moot question. The authorities wisely decided to clear up all of the ventilation problems by practical tests carried out in ways and upon scales as would furnish conclusive data. The research work has been finished; and its successful prosecution has called for a total outlay of 80-odd thousand dollars.

FOUR LINES OF INQUIRY FOLLOWED.

These extremely illuminating investigations have been fourfold in nature, and have supplied information which will be of outstanding value in a number of fields of engineering. Indeed, some of the results directly contradict previously accepted theories, and by reason of this are epoch-making in their significance. The first two lines of inquiry had to do with the character and quantity of the exhaust gases generated by internal combustion engines when running and with the physiological effects of certain components of these gaseous mixtures —particularly carbon monoxide.

The purposes of the latter research were to ascertain how human beings and animals would react when breathing for different intervals an atmosphere polluted with various proportions of carbon monoxide. The desire was to determine how long such admixtures could be inhaled without injury to health, and to establish the maximum of carbon monoxide that might be carried into the body the while without harming even persons of feeble constitution.

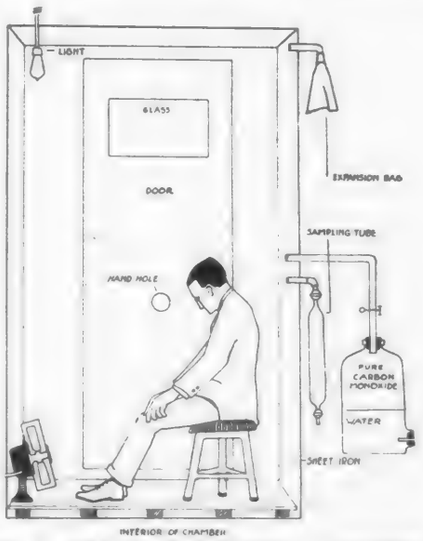

FIG. 1. SMALL EXPERIMENTAL CHAMBER AT YALE UNIVERSITY.

ROAD TESTS IN PITTSBURGH TO DETERMINE AMOUNT OF CARBON MONOXIDE PRODUCED BY AUTOMOBILE ENGINES.

Inasmuch as the questions for investigation were closely allied with the proper ventilation of many mining undertakings, the U. S. Bureau of Mines stood ready to collaborate with the

FIG. 2. EXTERIOR OF SMALLER EXPERIMENTAL CHAMBER AT YALE UNIVERSITY, SHOWING PHYSIOLOGIST (AT LEFT) TAKING BLOOD SAMPLE FROM FINGER OF VOLUNTEER WITHIN CHAMBER.

Tunnel Commission, and the Government has, therefore, played a notably helpful part in the prosecution of the several phases of the whole inquiry. Road tests with 101 motor vehicles, including representative types of passenger cars and trucks, were conducted by the U. S. Bureau of Mines at the Pittsburgh Experiment Station, in accordance with a program laid out by Clifford M. Holland, chief engineer for the New York and New Jersey Tunnel Commission. These tests extended over an interval of ten months, beginning in December of one year and ending on the last of September succeeding—thus covering both winter and summer operating conditions.

The cars used were taken at random from those offered by private individuals, corporations, and automobile dealers of Fittsburgh; and under the circumstances the results may be considered fairly typical of motor vehicles actually running on the streets at divers speeds and upon changing grades. No alterations of carburetors or other adjustments were made; and the cars and trucks contended with physical situations much like those which will exist in the two tubes.

It does not serve the present purpose to describe at length the painstaking investigations made at Pittsburgh, nor the agencies employed to gather and to analyze the exhaust gases given off by the cars when accelerating, when climbing a grade or descending, when the vehicles were standing and their engines racing, or when similarly halted and the engines idling. It suffices for us to know that it was discovered that the average volume of carbon monoxide produced was considerably higher than previously computed. This meant that the ventilating plant would probably have to deliver more fresh air into each tube than had originally been deemed necessary. Here was a revelation that potentially entailed a larger blower equipment and a heavier annual outlay for electric power

Pittsburgh Findings Offset by Tests at Yale University.

Happily, physiological inquiries at New Haven led to disclosures that offset the findings at Pittsburgh. This work was conducted at Yale University under the supervision of Professor Yandell Henderson, acting pro tem for the U. S. Bureau of Mines and indirectly for the Tunnel Commission. It was recognized by this physiologist that, inasmuch as the ventilation of the tunnel ought to be ample enough to obviate not only danger but even slight discomfort to persons in transit, his function was to ascertain the maximum permissible absorption of carbon monoxide by the body within the limit just mentioned. Prior to this investigation at Yale there was no precise definition of allowable vitiation of the air by admixture with carbon monoxide.

The tunnel engineers had earlier estimated that it would not be unsafe for passengers in the tubes to breathe an atmosphere containing three parts of carbon monoxide in 10,000 parts of air; and they had planned that the atmosphere in each tube should be changed completely at regular intervals of 90 seconds. Even so, it was recognized that the ventilating plant would have to be made up of 65 electrically-actuated blowers, ranging from 20 to 300 horse-power each; and this equipment was sure to call for heavy annual expenditures for operating current. Professor Henderson, after exhaustive experiments on human beings and animals, proved that a still higher percentage of carbon monoxide could be inhaled without inconvenience or hurt for a much longer time than would be requried to make the journey through the tunnel at the very slowest pace.

In one series of tests the subject was placed in a compartment that could be made airtight and which had a capacity of 226 cu. ft.; in the second series a chamber having a capacity of 12,000 cu. ft. of air was employed. In this was installed a Ford car and several persons were exposed to the variably vitiated atmosphere. When the small compartment was used, measured amounts of pure carbon monoxide were introduced after a subject had entered, and at different intervals the latter shoved his hand through a self-sealing elastic

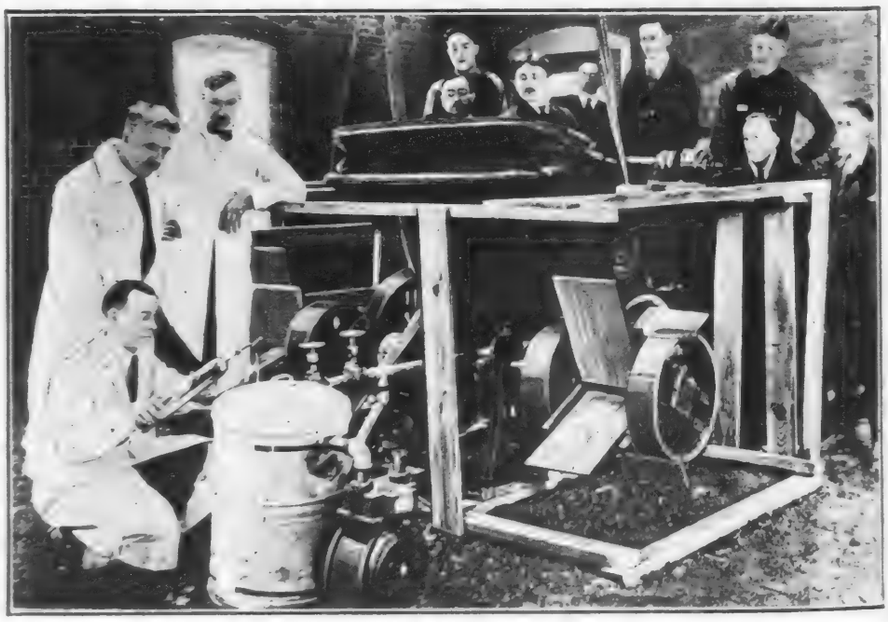

FIG. 3. LARGER EXPERIMENTAL CHAMBER AT YALE CONTAINING SMALL AUTOMOBILE.

panel so as to facilitate the withdrawal of blood for analysis.

Persons submitting themselves for tests spent periods of one hour in an atmosphere containing from two to eight, and in one case ten, parts of carbon monoxide in 10,000 parts of air. While they sat and read most of the time, there were a sufficient number of acts—such as turning on an electric fan, to insure a thorough diffusion of the gas, standing up to look out of the window a moment, opening and closing flasks to take air samples for later examination, etc.,—to correspond fairly well with the activity of a driver of a car. Doctor Henderson says: "When we speak of the absorption of carbon monoxide by a person 'sitting at rest' the condition must be understood as only such moderate rest as just described."

FIG. 5. DESIGN OF FRESH-AIR EXPANSION CHAMBER, INTENDED TO DISTRIBUTE THE AIR OVER A WIDE VERTICAL ARC, AND AT THE SAME TIME, TO CARRY IT THE MAXIMUM DESIRED DISTANCE TOWARD THE IMAGINARY ROADWAY CENTER-LINE.

Taking the Blood Samples.

Blood to the amount of 20 or 30 drops was drawn from a finger before the volunteer entered the chamber; and 0.02 c. c. was similarly obtained in the middle of the period and at the end, and usually once or twice during the succeeding three hours. These samples of blood were analyzed for carbon monoxide. It appears that no one had an appreciable degree of headache after remaining one hour in the chamber, during which the atmosphere contained four parts carbon monoxide or less. With six parts the effect, if any, was usually very slight. With eight parts there was decided discomfort for some hours, although not enough to interfere with efficient work in the laboratory or at the desk. After an hour, with ten parts, even an exceptionally resistant individual was rather miserable; averse to effort for five or six hours; and could still feel the effects after half a day.

In the case of the experiments in the larger chamber, where the air was tainted by the actual exhaust of an automobile, the disclosures in no wise differed radically from those already referred to; and the net result of the findings was that men, women and children—including infants and invalids—not to mention soldiers, who might have to march through the tunnel, could in perfect safety breathe for an hour an atmosphere admixed with four parts of carbon monoxide. Tests with horses and dogs revealed a kindred measure of immunity.

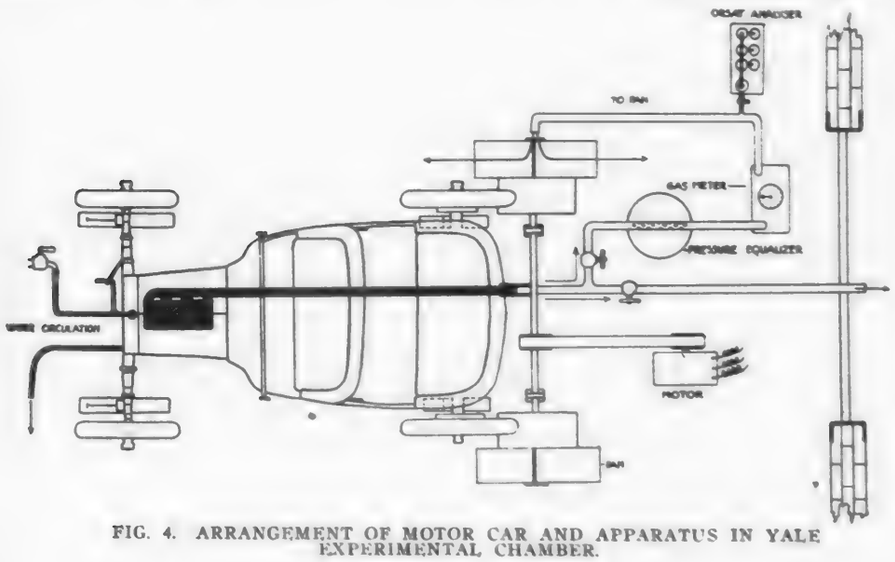

FIG. 4. ARRANGEMENT OF MOTOR CAR AND APPARATUS IN YALE EXPERIMENTAL CHAMBER.

The researches at Yale, while minimizing the disquieting motor-vehicle investigations at Pittsburgh, did not, however, completely neutralize the possible consequences of the unexpectedly large propagation of noxious gas by cars and trucks, and the question still remained whether or not ample ventilation could be assured without increasing the proposed blower installation of the air distributing system. The settlement of this problem directly concerned the annual cost of operation. An answer to this query was obtained in a thoroughly practical manner by a second series of investigations.

Experiment at University of Illinois.

The first of these studies was pursued at the Engineering Experiment Station of the University of Illinois under the supervision of Professor A. C. Willard and in accordance with a program prescribed by Mr. Holland. There was built at Urbana, Ill., a half-size trial-duct 300 ft. long. This duct was constructed of reinforced concrete and timber, and was patterned along the lines planned for the full-sized duct designed to be located beneath the roadway of each of the tunnel tubes. Under the terms of the contract entered into with the university, the work at Urbana was to deal specifically with the following subjects: first, the determination of the coefficient of friction of air flowing in concrete ducts such as were proposed for the vehicular tunnel; second, the verification of formulae used in computing the power required for moving air through a duct from which air would be drawn off at designated intervals; and third, the measurement of power losses due to bends in flues, ducts, or airways.

As will be readily grasped, the scope of the tests at Urbana was such as might be expected to reveal how the ventilating air could be effectually distributed and what modifications of design, if any, would be needful to achieve this end with the least possible blower energy. The experimental duct was surmounted and straddled by three reading stations, each of which was equipped with suitable gauges for indicating high, low, and intermediate pressures. Further, within the duct were installed Pitot tubes and Piezometer plates for registering

pressures and velocities at various positions in the duct cross-section.

Along each side of the duct, at prescribed intervals, there were ports or outlets. These represented discharge passages by which, in the vehicular tunnel, fresh air would reach both flanks of the roadway; and the openings were fitted with adjustable shutters that would either seal the ports or facilitate regulating the escaping air. Thus, it was practicable to gauge the pressure, volume, and velocity of the air issuing from these outlets. At the admission end of the duct there was placed an electrically-driven blower having a rated capacity of 105,000 cu. ft. of air per minute at a pressure of 7 in.

During the earlier tests the farther end of the duct was generally closed and the exhaust air reached the outside atmosphere via the side ports. Under this condition the duct simulated the proposed method of ventilating the vehicular tubes. That is to say, the ventilating ducts in either of the tubes are not intended to furnish an uninterrupted flow of inbound and outbound air from portal to portal. These ducts will be blocked by bulkheads at the center of the river; and the blower equipment on each bank will therefore take care of only half of the length of the tunnel. Such being the case, the primary experiments were devoted to ascertaining whether it would be feasible to get a fairly uniform supply of air at all points of the duct, and this at pressures that would not be markedly different at stations close to the blower and at those remote from it. It was thought that the first and middle sections of the duct would have enough air but that the third or last section might show a deficient flow. Contrary to expectations, the most distant stretch of the conduit gave an ample discharge, and this was discovered to be due to the back pressure built up in that area, while the middle division fared worse despite the shorter distance from the fan This meant that the outlets in the middle section of the duct would have to be larger than those in the third one in order to provide the required volume of fresh air to effect the needful dilution of motor gases throughout the corresponding part of the actual tunnel. This disclosure contradicted the commonly-accepted theory applicable to similar cases.

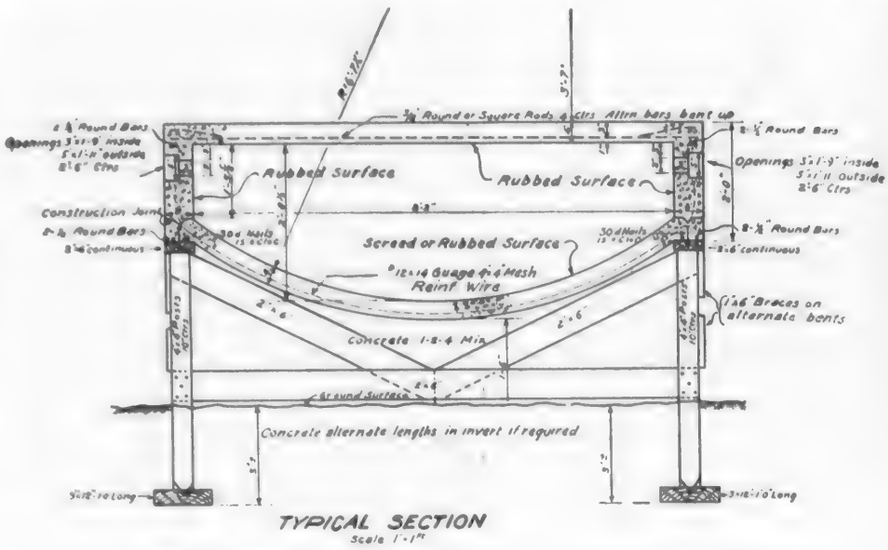

FIG. 7. TYPICAL SECTION OF EXPERIMENTAL AIR DUCT AT UNIVERSITY OF ILLINOIS, URBANA, ILL.

Coefficient for Friction in Air Flow Through Concrete Ducts Found to Be Too High.

The foregoing researches emphasize not only the errors of prevailing formulae but establish the fact that the coefficient of friction usually employed in connection with the flow of air in concrete ducts, etc., was about 100% too high. This was a heartening discovery. Previous data had been secured by somewhat modest laboratory investigations, while the scale of the duct used at Urbana was large enough to prevent the mistaken deductions of earlier workers in the field.

Development of Expansion Chamber to Secure Quick Dispersion of Fresh Air.

Another line of inquiry had to do with the evolution of a type of expansion chamber which would best serve to insure the widest dispersion of fresh air in the neighborhood of the tunnel roadways. Twenty-five different models of expansion chambers were tested at the Urbana Engineering Experiment Station before one was evolved which would give satisfactory diffusion. The accepted pattern is so shaped that air issuing from it at a velocity of 1,000 ft. per minute has no appreciable force at a distance of but five feet away, and yet the impulse will carry the air quite to the middle of the driveway. In

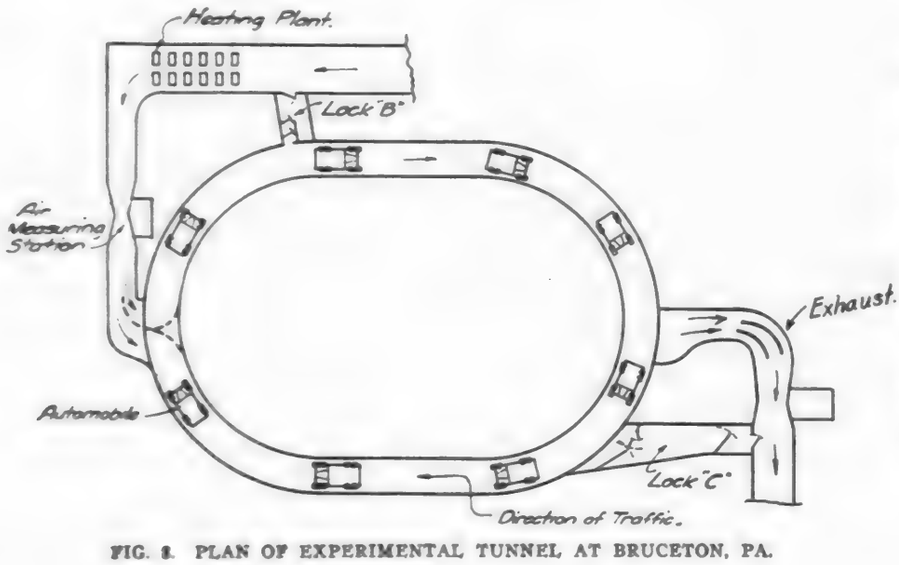

FIG. 8. PLAN OF EXPERIMENTAL TUNNEL AT BRUCETON, PA.

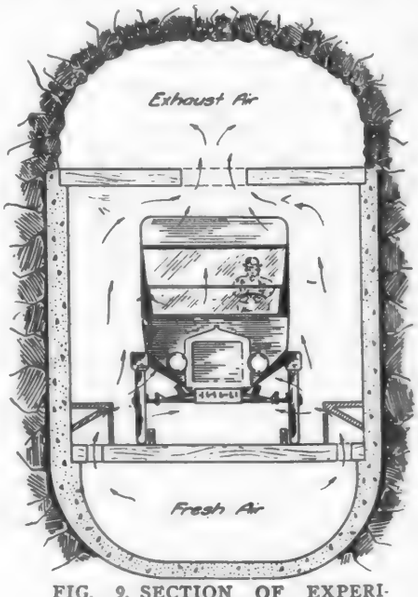

FIG. 9. SECTION OF EXPERIMENTAL TUNNEL AT BRUCETON, PA.

FIG. 6. VIEWS OF EXPERIMENTAL TUNNEL AND AIR-MEASURING APPARATUS AT ENGINEERING EXPERIMENT STATION OF UNIVERSITY OF ILLINOIS, URBANA, ILL.

1. Interior of experimental air duct, with Pitot tubes and Piezometer in position.
2. Cone measuring apparatus for determining air flow from ports.
3. Interior of one of the three reading stations located above experimental air duct.
4. General view of experimental concrete air duct.
5. Combination elbow and connecting flue, full size, typifying junctions in the Hudson River tunnel between the two tubes and the four ventilating shafts.
6. Side ports in experimental air duct corresponding to the passages by which fresh air will be supplied to the vehicular tunnel.
7. Experimental air duct seen from the blower end. The fan, which is electrically-operated, is capable of furnishing 105,000 cu. ft. of air per minute at a pressure of 7 in.

FIG. 10. AIR SAMPLING AND TEMPERATURE-RECORDING CHAMBER ADJOINING THE SPEEDWAY OF THE BRUCETON EXPERIMENTAL TUNNEL.

This Station was linked by tubing with numerous air-sampling bottles placed in different parts of the tunnel. At the right are electrical indicators which were connected by wires to thermo-couples located on and in the walls of the tunnel. The object of the latter apparatus was to determine the amount and the rate of diffusion of heat through the tunnel walls and emanating from the automobile engines.

other words, the fresh air entering from each flank of the tube will meet in the center of the cross-section and provide complete circulation.

Power Losses Due to Bends in Flues.

The concluding studies at Urbana were directed to determining power losses due to blowing air through the bends of flues, etc., and with this in view full-sized elbows of several sorts were tentatively tried out before erecting a combination elbow at the far end of the 300-ft. duct. This elbow represented a union such as will be formed where the vehicular tunnel tubes join the four ventilating shafts through which fresh air will be fed downward and foul air will be drawn off and sent aloft to the free atmosphere. In the elbow the air is obliged to make two turns, each of 90°, and it was important that the change of route should not invite any needlessly increased resistance.

There is a well-recognized law that the inner or short radius of a duct shall be equal to the diameter of that passageway. This could not be subscribed to and the desired result realized because of the large diameter of the elbow. The area of that conduit was bound to induce a high coefficient of friction by reason of the lessened velocity of the air stream threading its way through the compound turn. As the textbooks tell us, the coefficient of friction varies with the velocity—i. e., the greater the velocity the lower the coefficient of friction. The technicists solved the problem by interposing a vane or longitudinal partition in the airshaft; and by this agency the single passageway was transformed into two, each of them having a short radius such as would meet the theoretical requirements. This divisioning caused the air to rush more rapidly through the tortuous channels; and the added velocity so diminished the frictional resistance that the impulse power was reduced at the elbow by quite 25%.

The researches at Urbana, together with the finding at Yale, completely counterbalanced the rather discouraging revelations of the motor-vehicle gas tests at Pittsburgh; and the only ventilating question still awaiting settlement was whether the fresh air should be fed up into the tubes from the ducts below the roadways or downward from similar conduits overhead. Once more the tunnel engineers besought the aid of Government experts. It will be recalled that opinions differed as to where the supply and the discharge ducts should be located; and there was much logic in the argument that the engine gases could be disposed of quickest and by the shortest route if they were carried off near their points of origin—i. e., by exhaust ducts running beneath the floors of the tubes.

The Bruceton Experiments.

In order to approximate the subterranean circumstances that will characterize the Hudson River vehicular tunnel, a test tunnel, 130 ft. below ground, was utilized. This tunnel, nearly oval in form, was constructed at Bruceton, Pa., in the experimental coal mine of the U. S. Bureau of Mines, and was the result of uniting two existing parallel drifts by curved terminal galleries. Within this tunnel, which has an axial length of 400 ft., was built a timber-and-reinforced driveway having a rectangular cross-section 9 ft. wide and 7½ ft. between the floor and the ceiling. Underlying the floor is a duct 4 ft. high and above the ceiling there is another conduit 5 ft. high, and arrangements were made by which either duct could be used at will for exhaust or supply purposes.

At eight stations, set 5 ft. apart, on one of the straight sections of the under-ground speed-way, were hung at different elevations groups of sampling tubes. These were connected by piping with a central station whence air from all of them could be pumped. An interval of half an hour was needed to fill the sampling tubes for testing. The number of motor cars run during the investigations ranged from one to eight, and each of these vehicles also carried sampling tubes—one on top, one at the driver's feet, and a third intermediate between these extremes. The automobiles were driven uniformly at a rate of ten miles an hour. Chauffeurs and passengers were subjected to examination before and after every trip by physicians and physiologists; and the machines were operated for one-hour periods. Besides exhaust-gas sampling apparatus, each motor was provided with gasoline measuring facilities; and there were air sampling tubes interposed in the

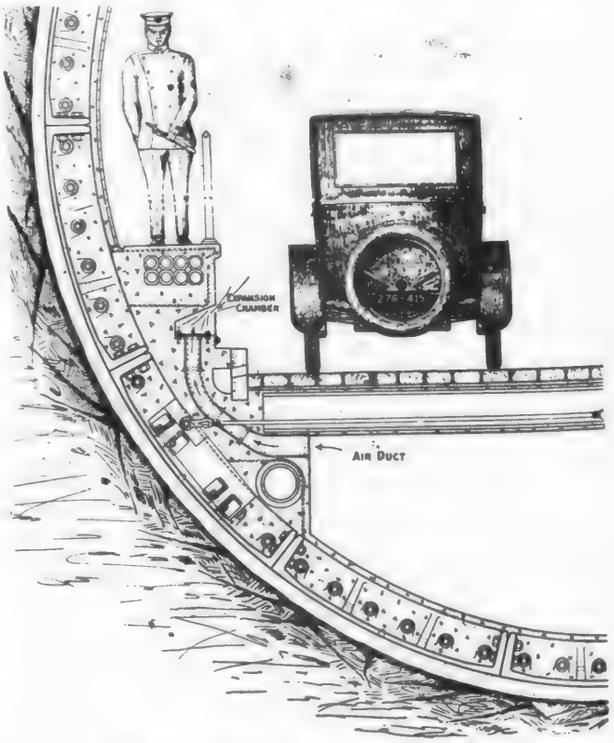

FIG. 11. PARTIAL CROSS-SECTION VIEW OF THE HUDSON RIVER VEHICULAR TUNNEL.

exhaust duct at one station, where samples were taken continuously to determine the make-up of the air as it left the tunnel. In brief, care was taken to guard against any possible errors through a comprehensive counterchecking system; and it was practicable to determine the composition of the air at any vertical or longitudinal point in the tunnel.

All told, seventeen ventilating experiments were made at Bruceton—six of them with the fresh air reaching the driveway from overhead and eleven of them with the fresh air issuing from the duct beneath the floor. During these, two runs were made with one car, two with three cars, five with four cars, and eight with eight cars. While it was ascertained that there was apparently no striking difference between upward or downward admission of fresh air, what difference existed was in favor of upward circulation. Further, the developed structural features of the tunnel made the latter course more desirable. On the other hand, the physiologists found that the absorption of carbon monoxide by the blood was less with the rising movement of the air than with the descending flow—the percentage of CO in the atmosphere being the same in both cases.

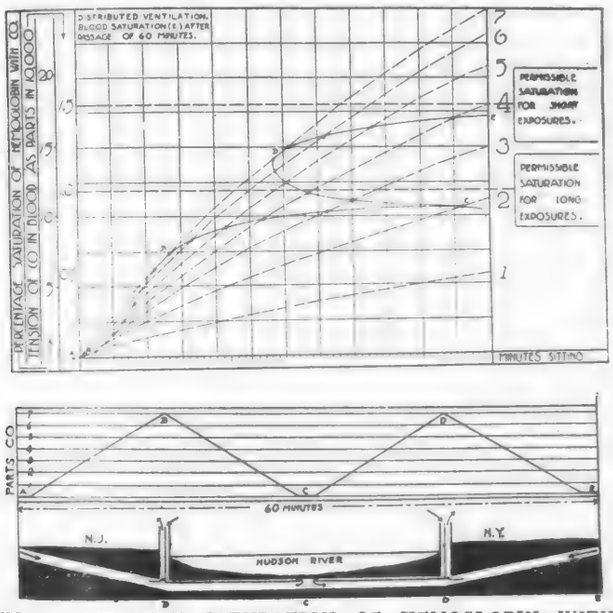

FIG. 12. PER CENT. SATURATION OF HEMOGLOBIN WITH CARBON MONOXIDE IN RELATION TO THE ATMOSPHERE IN DIFFERENT SECTIONS OF THE HUDSON RIVER VEHICULAR TUNNEL.

Carbon monoxide, at atmospheric temperatures, is a trifle lighter than the air, and the total average of all the exhaust gases from a motor car—at equal temperature, is also somewhat lighter than the air. Therefore, the hot engine exhaust has a pronounced tendency to ascend when discharged. This is accelerated by the eddy or partial vacuum at the rear of an advancing car and is further stimulated by an inrush of fresh air impelled ceilingward from low-lying expansion chambers. In other words, the noxious gases in the vehicular tunnel will thus be swept toward the ceiling and got rid of before they will have a chance to diffuse and to contaminate seriously the continually changing atmosphere.

The underground tunnel at Bruceton had a heating plant, and being 1,050 ft. in from the pit mouth of the mine it was practicable to maintain reasonably uniform temperatures, and to reproduce at will conditions substantially identical with those that will prevail at various seasons within the tubes that are to be driven beneath the Hudson River. It is well worth stressing the fact that the comprehensive inquiries described settle not only how best and most economically to ventilate the tunnel in question, but they provide data of great value for many other engineering undertakings and show wherein the technical manuals of to-day err.

STATISTICS OF NEW YORK-NEW JERSEY VEHICULAR TUNNEL

Construction	Cast-iron tubes
Number of tubes	two
Mean diameter of each tube	29 ft.
Lowest depth below mean water	60 ft.
Span from portal to portal	8,500 ft.
Estimated daily traffic	17,000 conveyances
Estimated daily traffic at end of sixth year	24,000 conveyances
Estimated daily traffic by 1940	56,000 conveyances
Aggregate horse-power required to operate blowers	6,500
Total air movement per minute	3,500,000 cu. ft.
Air flow on upgrades per minute per foot of tunnel	293 cu. ft.
Air flow on down grades per minute per foot of tunnel	125 cu. ft.
Air flow on level portions of tunnel per minute per foot of tunnel	225 cu. ft.
Estimated CO in 10,000 parts of air, secured by this distribution	Not over 4 parts

Standard Versus Random Pipe Lengths.

A suggestion that wrought pipe be manufactured in lengths of 12 ft. for sizes 4 in. and under has been made more than once and the question can be asked, why not? As pointed out by a writer in *Valve World*, such a standard would be of value, as pipe of this length could be loaded on flat cars in two stacks, one on each end of the car, over the trucks. This method would decrease the weight in the center of the car and allow the pipe to be easily loaded and unloaded through the doors of box cars. Furthermore, dealers could readily count the lengths and deliver them with a mixed load.

As now made, pipe extends far beyond the ends of the short wagons used by contractors, thereby endangering the public whenever the wagons turn street corners. Again, it is almost impossible to get pipe into a building from a narrow alley, as the turn cannot be easily made.

Pipe longer than 12 ft. is seldom required as valves or fittings are usually placed in the mains or risers before this distance is exceeded.

Brass pipe has been made in lengths of 12 ft. for three years and there is apparently no complaint due to additional losses on the installation or scrap. Likewise, cast-iron soil pipe in lengths of 2½ ft. and 6 ft. are no longer made, as the use of such length was found of no general advantage.

Return to Steam and Water Heating Companies.

In recent rate cases, the Illinois Public Utilities Commission's findings as to a fair rate of return have been influenced by the present financial situation, and the rate of interest that is now required to attract new capital into the utility business. As a result, the Commission has made findings that various companies supplying steam and hot water service should be permitted to earn as high as 8% upon the fair rate-making value of the property.

Rates of Utility Furnishing Combined Services.

The Montana Public Service Commission holds that confiscation in the matter of rates is to be determined by the same rule whether an individual or a corporation professes one public service or six different public services. In the case of a company such as the Eastern Montana Light & Power Company, a utility furnishing electric and also steam heating service, the test is whether the particular service sustains itself; not whether it can subsist by operating from some other service or the private purse of the owner.

STEAM WASTE IN HEATING RAILROAD COACHES

With a Review of the Development of Present Car Heating Methods and Notes on the Economic Value of Thermostatic Control

BY T. W. REYNOLDS.

AN interesting series of tests which has recently become available in connection with the heating of railroad coaches brings out in a striking manner the enormous wastage of steam which goes on every day during the heating season in the railroad yards of the country, as well as the savings that are possible through the adoption of temperature regulation. Nor is any account taken in these figures of the losses where cars under steam stand for long periods with their windows wide open, as they do in at least two of the country's largest terminals. In such cases, of course, no savings can be expected from heat-regulating devices.

Judging from the tests, which are presented herewith, it is quite conservative to say that wherever thermostatic temperature regulation is applied to steam heating in railroad passenger equipment, it effects far greater economies than can be obtained with similar regulation in any other field of heating and ventilation.

How rapidly the consumption of steam increases with temperature in the car higher than necessary is exemplified in the following table compiled from tests made on wooden coaches.

INCREASED STEAM CONSUMPTION WITH TEMPERATURE HIGHER THAN NECESSARY IN CAR

Temp. diff. between outside and inside temperature, deg. F.	Heat Supplied per hour. B. T. U. Approx. Total.	Per Cu. Ft.	Steam Consumption in pounds per hour
10	4000	0.6	4
23	12000	2.1	12
30	23000	4.4	24
40	40000	7.7	41
50	65000	11.7	67
60	85000	15.9	87

This table leads to conclusions which can be summarized in tabulated form as follows:

POUNDS OF STEAM REQUIRED PER HOUR IN RAILROAD CARS.

Outside Temp. Deg. F.	Temperature within car, Deg. F. 50	60	70	80	90
0	67	87	—	—	—
12	41	67	87	—	—
20	24	41	67	87	—
30	12	24	41	67	87
40	4	12	24	41	67

It will be noted from this summary that, for example, at an outside temperature of 40° F., a car heated to 80° consumes almost three and one-half times as much steam as compared with heating to only 60°.

Thus the amount of waste which occurs when cars are overheated is apparent, though it is perhaps not so apparent that conditions of this kind occur mainly while cars are standing in terminals. For instance, the car mileage of heated passenger equipment reported for a large eastern railroad during the seven winter months of 1914-1915 was 78,312,000, or about 366,000 cars miles per 24 hours. Taking 2300 cars in service and figuring approximately 13% crippled, leaves 2000 cars making the above mileage, corresponding to an average of 183 miles per car in 24 hours. Dividing 183 miles per car by an average speed of 33 miles per hour gives 5.6 hours as the running time thus leaving 18.4 hours at terminals out of each 24 hours.

The length of time railroad coaches are standing in terminals and the amount of steam consumed during that time were also brought out rather prominently in records taken at two large railroad terminals where steam meters have been permanently installed in the steam supply lines used extensively for heating cars. These meters record the total amount of steam used at these points for car heating, including condensation losses occurring in transmitting the steam from the boiler plants to the cars. During the month of February, 1916, an accurate record was kept of the number of cars connected to steam and the length of time the cars were connected; also temperatures and other conditions of importance. The results of this investigation are tabulated in condensed form as follows:

RECORD OF CAR HOURS ON STEAM AND OTHER CONDITIONS AT TERMINALS.

	Terminal No. 1 Coaches	Pullman	Total	Terminal No. 2 Coaches	Pullman	Total
Number of cars entering	30963	11448	42411	5842	5823	11665
Number car hours on steam	66653	8544	75201	71555	80927	152482
Cars with open windows, %			26			50
Average outside temp. deg. F.			27.7			27.7
Average temperature in cars, deg. F.			75			75
Total steam condensed, in 1000 lbs. *			14877			26885
Steam per car per hour, lbs.			198			178

The temperatures maintained in the cars were found to average about 75° but there is reason to believe that they would have been higher if the yard forces had not been cognizant of the records being taken. An indication of how high the temperature in cars is allowed to run is the fact that a car not under test was discovered with a temperature of 147° F.

PECULIAR CONDITIONS AFFECT DESIGN OF CAR HEATING EQUIPMENT.

In considering the tests it should be borne in mind that it is only in connection with the heating of passenger equipment that the building or space heated is in motion, sometimes rapid, sometimes slow and usually variable, as are all the other conditions—standing and running—doors opened at frequent intervals and for lengthy periods, windows and ventilators periodically opened and shut, while the number of passengers, also variable, is usually large in proportion to the cubiture of the space heated.

Cars en route finally reach terminals and, as has been shown, stand for hours under different conditions and requirements—piping must be kept from freezing and cars heated to a point from which their temperature may quickly be raised as required when again in service. The extent of glass exposure is large and many cars are now of steel and when stored and allowed to cool require heating for two or more hours before the desired temperature is reached, consuming, in the meanwhile, enormous

* Includes losses in transmission from boiler plant to cars.

quantities of steam which, like all steam used in car heating, when condensed is not returned to the boiler but is wasted by direct discharge to the atmosphere.

EVOLUTION OF CAR HEATING

In the early years of railroading it was evident that something should be developed for the heating of passenger coaches which would be safer and better than stoves using coal or wood in each individual car. Hot water and steam were the only other practical heating mediums and of these, gravity hot water systems were first considered and were used for some time, in particular on cars that were liable to stand at isolated places. Such systems, however, did not do away with the necessity for stoves, which were still required to heat the circulating water, although in some cases, steam was used for this purpose, but with steam piped from the locomotive to heat the water, the system became complicated and expensive. As a consequence, steam instead of water or water heated by steam is used almost universally today for the heating of coaches, being supplied to the train line by the locomotive when running and from the locomotive or boiler plant when cars are standing in terminals.

Objections have been raised from time to time to the use of steam, because of the high pressure causing injury to passengers, either from scalding or failure of the apparatus, especially in train accidents. However, by means of connecting piping, insulated but exposed beneath the train and known in railroad parlance as the "train line," it is now possible to carry steam with a degree of safety from the locomotive the full length of the train, using automatic couplings between the coaches, so that very little time is lost in making up a train.

As for electricity, which is used only in coaches of suburban or local trains on electrified lines where steam is not available and with which this article does not deal, it is sufficient in passing to point out that where electric heating has been used, the heating load is about equal to the power load, hence its application to car heating, as elsewhere, has been found so costly as to

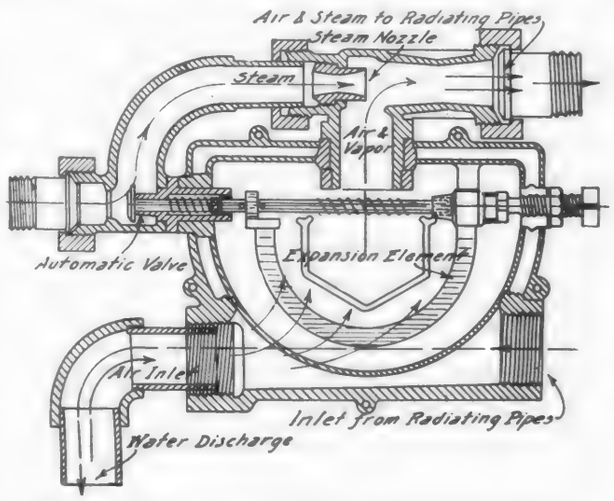

FIG. 1. DETAIL OF VAPOR REGULATOR FOR CAR HEATING SYSTEMS.

be prohibitive, except where necessity dictates its use. For express service or on through trains, such as those leaving the Grand Central Terminal on the electrified main line of the New York Central Lines and which change at Harmon from electric to steam locomotives, there is sufficient space in the electric locomotives for small flash or quick-steaming generators. Such trains are equipped with radiating pipes and train lines for continuation of steam heating when the steam locomotive is finally attached, since it is not feasible from the standpoint of economical first cost of installation to heat by electricity and later change to steam, or vice versa, and, in any event, steam heating, though wasteful enough, is far more economical than heating by electricity, as previously pointed out.

PRESSURE AND VAPOR SYSTEMS OF CAR HEATING.

Steam heating of coaches is divided into two general classes: pressure and vapor systems.

Pressure Systems (simple systems without any special appliances) use steam in the radiating pipes considerably above

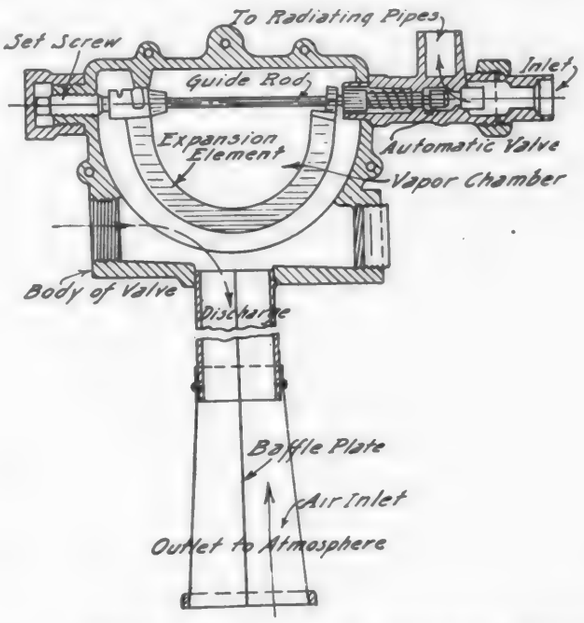

FIG. 2. —VAPOR REGULATOR WHICH MAKES USE OF EFFECT OF OUTSIDE AIR.

atmospheric pressure. Vapor systems, on the other hand, take high-pressure steam and convert it by some form of vapor regulator (as later described) to steam at or near atmospheric pressure, the pressure being enough to force air out of the system and overcome resistance of the pipe. A constant temperature of about 212° F. is also maintained on the surface of the radiating pipes, thereby eliminating the high temperatures as found in pressure systems, though radiation required for vapor systems is much greater, of course (due to lower temperatures) than that required for pressure systems, which means an additional cost for increased equipment.

Vapor train heating systems are one of the chief methods used on steam roads of today, having come into extensive use on account of (a) their somewhat better qualities of regulation as compared with variable pressure systems; (b) a greater degree of comfort offered to passengers; and, (c) the absence of steam pressure within the radiating pipes.

Pressure systems, with pressure-control mechanism for each coach, do not give the proper temperature regulation, because the long length of main train line pipe with its high heat losses, especially at couplings, and the consumption of steam at the different coaches causes a wide range in pressure between the front and rear coaches, sometimes 10 to 125 lbs. or more. Thus, in a long train, cars nearest to the locomotive receive steam at much higher pressure than those at the rear end of the train; in fact, pressure in the train pipe, as a rule, is regulated so as to reasonably satisfy the heating requirements of the rear coaches. Consequently, coaches use more or less steam, and thus have a higher or lower temperature, according to their location in the train, regulation at the locomotive, leaks, condensation, and other losses within the train line itself.

If either system is used, certain irregularities have to be contended with, such as varying range of pressure in train line while standing and in motion and varying outside temperatures and vibrations imparted to the heating system (including the

train line pipe and covering), from the motion of the train. It can readily be seen that due to these irregularities the satisfactory heating of passenger coaches presents much greater difficulties than the heating of buildings, and also that systems which satisfactorily heat buildings may prove very unsatisfactory for the heating of coaches.

OPERATION OF THE VAPOR REGULATOR

The vapor regulator previously referred to consists of two parts (Figs. 1 to 4),—a control valve which automatically opens

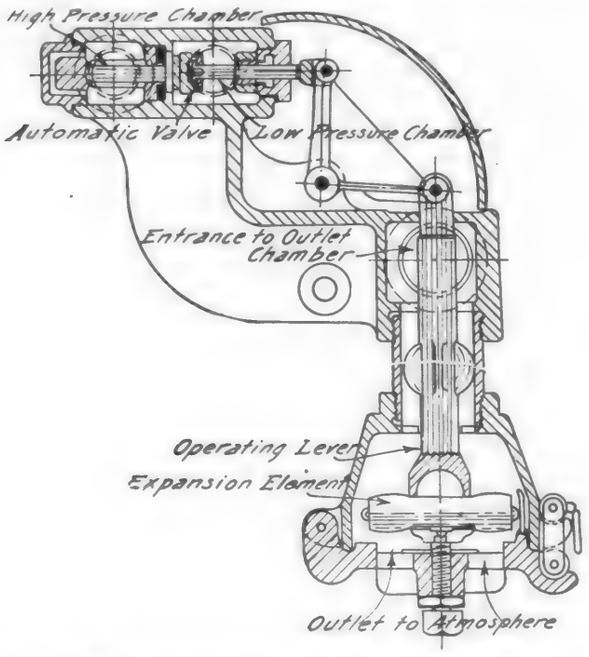

FIG. 3—VAPOR REGULATOR WHICH DEPENDS FOR ITS OPERATION MAINLY ON TEMPERATURE OF DISCHARGE WATER.

and closes the connection from the high-pressure steam train line to the inlet end of the low-pressure steam radiating pipes, and an expansion element which mechanically operates the control valve. The action of the expansion element depends upon the adjustment made for a predetermined temperature of the discharge water and air passing over it, such action being transmitted by means of connecting rods (Fig. 1) or levers (Fig. 3) so as to operate the control valve, thus admitting steam to the radiating pipes as required and maintaining it as * vapor therein in accordance with the temperature of the condensate. This reduction in pressure also tends to eliminate moisture in the steam, though, of course, no heat is gained.

When a car becomes heated to a higher temperature than that for which the expansion element has been adjusted by set screw, the condensate will increase in temperature, causing the expansion element to expand, and, as previously described, thereby reduce the flow of steam into the radiating pipes. In time the temperature in the car will become lower, and falling below the point of adjustment, cause a contraction sufficient to allow a further flow of steam into the radiating pipes, thus bringing up the temperature of the car.

So it will be seen that the action of the discharge water upon the expansion element tends in a way to keep the temperature of the car constant only for each adjustment of the vapor regulator. This is the governing factor in each of the ** four vapor systems illustrated in the sketches which follow, though in some of these systems certain auxiliary features have been added, such as the admission of air into the radiating pipes through the vapor regulator shown by Fig. 1, and the admission of air into the vapor chamber of the regulator as shown in Fig. 2. Both of these regulators are located within the car, from which point adjustments can be made. They are also interchangeable, that is, either can be installed in a car without additional piping.

In Fig. 1 the outside air drawn into the system by the injector action of the steam affects the expansion element, so that in cold weather, the increased flow of steam due to additional heating requirements, causes a greater amount of cold air to be drawn in, thus admitting more steam, while the vapor in the discharge pipe will also be drawn in and used over again. This method tends to make not only the inside temperature its controlling feature, but also the outside temperature.

The additional effect of the outside air is also claimed in the regulator shown by Fig. 2, use being made of a baffle plate so that when the train is in motion, air from the outside will act upon the expansion element, and in this way tend to supply the extra heat required when moving.

The vapor regulator shown in Fig. 3 is somewhat different than either of the other two. It is * located under the car, from which point adjustments are made, and depends nearly altogether upon the temperature of the discharge water for regulation of

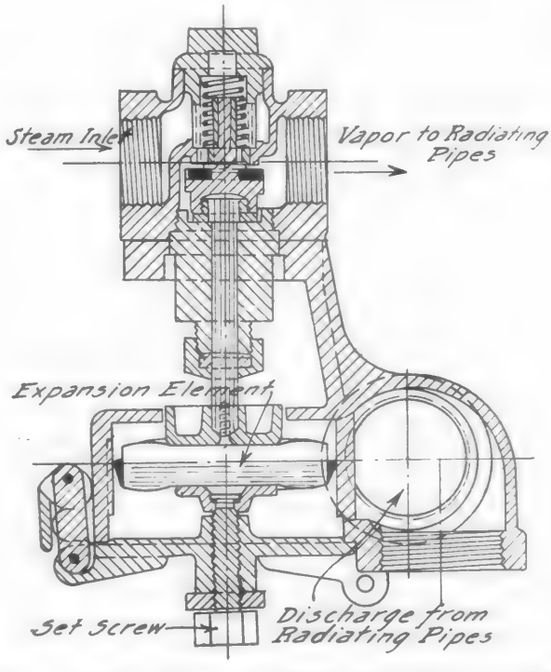

FIG. 4.—VAPOR REGULATOR WITH EXPANSION ELEMENT MADE OF SPRING BRASS.

car temperature, though the temperature and velocity of the outside air in passing around the discharge pipe have some influence.

So far as the design of the expansion element itself is concerned it depends upon the particular make of regulator, and may consist of a flat-shaped box made of spring brass (Figs. 3-4), or a U-shaped tube made of a non-corroding metal and filled with an expansion liquid hermetically sealed (Fig. 2), while in the case of Fig. 1 (similar to Fig. 2), fine shot is also included with the liquid. In all cases the expansion per degree change in temperature is limited by the force of the steam, friction of the valves, and port opening.

Any expansion element has its "critical point," which means it must be so adjusted that the action of the discharge water, vapor and air, with respect to temperature, must be at this point to give the best regulation. Consequently, all vapor regulators require accurate adjustment in order to secure the best efficiency in operation and not lose part of the available heat

* At or about atmospheric pressure.

** With one exception (Fig. 4) where only the vapor acts upon the expansion element, because the discharge water passes to one side. An opening not shown) leading to the discharge pipe allows the vapor to act upon the expansion element.

* Same location for the regulator shown in Fig. 4.

with the discharge water. All of these systems, for the most efficient temperature regulation at steam pressures from * 5 to 80 lbs., discharge the water at a temperature of about 180° F., and, considering a feed-water temperature of 60° F., about 10% of the heat is lost in the discharge. Thus, to obtain good regulation for all supply steam pressures, a sensitive element must be used to act quickly over small temperature changes and possibly sacrifice mechanical strength for wide temperaure variations, so that adjustments need not be made for each supply steam pressure to hold the condensation.

It also becomes apparent that vapor regulators should be so protected that only authorized persons can make changes in their adjustment for the reason that the accurate setting required is a delicate matter and can be done satisfactorily only by persons entirely familiar with the intricacies of their performance. Regulators should be adjusted before being placed on the cars, and the practice of making these adjustments on the cars to allow more or less steam to flow through the radiating pipes, not considering the discharge temperature, will give inefficient operation of the system.

The operation of vapor regulators is also affected by the radiation from high-pressure steam lines, radiating pipes and cut-out valves (if placed in their vicinity); also, in some cases, the vapor chamber will not stand high pressures. While it is not likely, should the end of the discharge pipe freeze up and full steam pressure be applied to the vapor chamber, it might burst and cause serious damage, depending upon its location. Furthermore, in all vapor systems no provision is made to shut off the steam in case of a leak in the radiating pipes, and in such an event, discharge water leaving at the break, would cause the expansion element to become inoperative, thereby allowing steam to flow at a greater rate. This, however, is probably a minor objection, since an accident serious enough to break the radiating pipes would probably open the train line.

* Total heat—1156 to 1185 B. T. U.

In the further discussion of this subject, in next month's issue, the author will discuss temperature regulation systems for cars and other features of their heating equipment.

PNEUMATIC CONVEYING SYSTEM FOR EMPTYING FIBRE BINS

Use of Double Fans, Operating as Two-Stage Blowers, to Handle Steamy and Matted Stock

BY JOHN L. ALDEN.

THE pneumatic conveying systems here described are unusual in that they employ double fans operating as two-stage fans. These systems are the means of emptying bins of steamy, matted fibre.

Fig. 1 shows the general arrangement, and it will be seen that all of the material passes through the fans and thence to the collector on the roof of an adjoining mill. The vertical lift is about 70 ft.

Since the emptying of bins is done by a low grade of labor, the fan systems are subject to abuse owing to irregular feeding of stock. The long fibres mat together easily, and it is customary for two men to roll up a cylindrical mat 5 or 6 ft. long, and as large in diameter as can be stuffed into a 30-in. pipe. Since the air velocity in the suction pipe is about 4000 ft. per minute, the fan wheel receives a tremendous blow when struck by a slug of this material.

The operating time per day averages about 6 hours, and it is not uncommon for one fan to handle as much as 100,000 lbs. of stock per day. With regular and continuous feeding the system could undoubtedly handle a great deal more material, since repeated trials have shown that one man can feed 400 lbs. per minute without blocking the pipes.

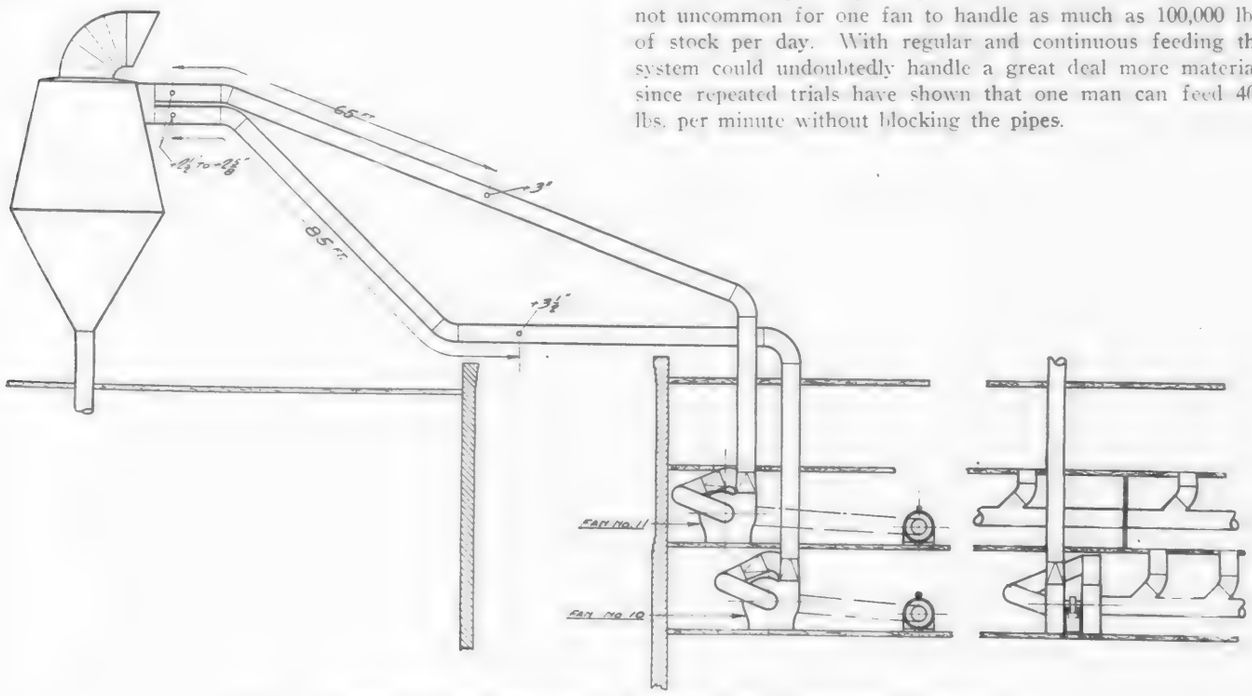

FIG. 1. GENERAL ARRANGEMENT OF PNEUMATIC CONVEYING SYSTEM.

IMPORTANCE OF KEEPING DOWN PERIPHERAL SPEED OF FANS.

Based on experience with other stock-handling systems, it was decided when designing the two in question, to keep down the pheripheral speed of the fan wheels as much as possible. It was thought that in this way greater freedom from shut-downs, and greater durability of fan wheels could be obtained. the smaller diameter and lower rim speed reduce the wheel stresses due to rotation alone, and it seems reasonable to believe that the impact of the stock on the blade faces sets up considerably lower stresses at the reduced speed.

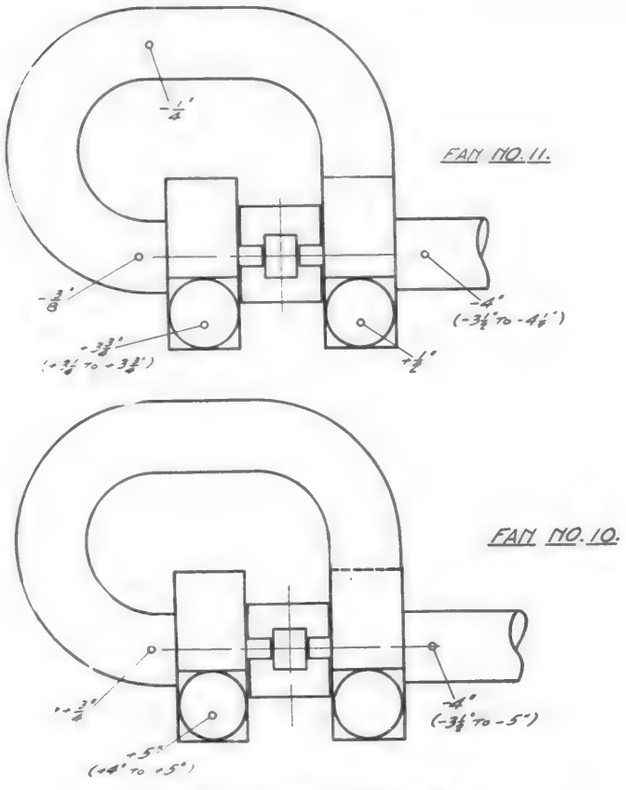

FIG. 2. DETAIL OF SYSTEM.

To accomplish this speed reduction it has been necessary to compound the fans, producing one half of the necessary pressure in each fan. Fig. 2 shows this arrangement quite clearly. The discharge from one wheel blows into the casing inlet of the other. Two single fans could have been employed, but the use of a double fan offers advantages of simplicity of drive and control. Each double fan is driven by a 50-H. P. motor through a 10-in. double belt. Mounted with the starting compensator is an ammeter, so that fluctuations of power input may be instantly read.

SEVERITY OF SERVICE.

The specially-designed fans are No. 70 double exhausters, exceptionally heavy in construction. The wheel, shown in Fig. 3, weighs about 800 lbs. Both the inlet and outlet are 30 in. diameter. To illustrate the severity of the service, it is only necessary to say that the life of a wheel is from 3 to 15 months. Wheels usually fail by the fracture of the 5-in. tee arms.

The static pressures when handling air only, are shown in Figs. 1 and 2. When handling stock, the pressures fluctuate widely, as shown by the values in brackets. As each slug of stock

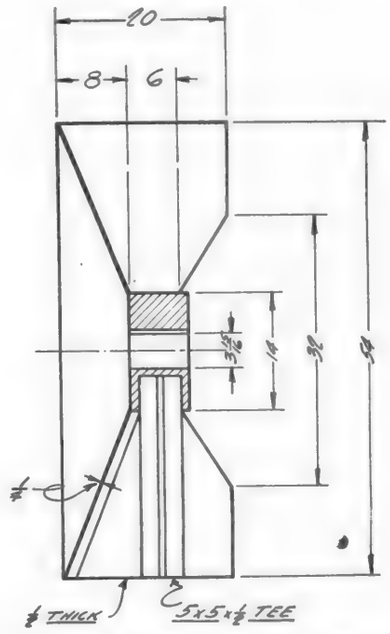

FIG. 3—800-LB. WHEEL USED IN PNEUMATIC CONVEYING SYSTEMS.

enters the suction pipe, the vacuum jumps violently owing to the sudden restriction of the inlet area. At the same time, the back pressure drops and the ammeter needle falls to about two thirds the normal figure. At the instant the slug strikes the fan wheel, the power jumps to 60 to 65 H. P., and the belt slips perceptibly. The fluctuation of pressure and power lasts for about 5 seconds, the time that the mass of fibre is in the pipe.

The pressure developed by a two-stage fan is equal to the sum of the pressures developed by each stage, minus the loss between stages. For the usual pipe connections between inlet and outlet the loss is about 0.75 times the velocity head. Each half of the double fan must be large enough to handle the entire volume at one-half the pressure developed by both fans.

DAYLIGHT SAVING A COOLING PROPOSITION

By G. J. O'CONNOR.

Editor's Note.—In all the arguments which have been advanced in favor of the daylight-saving idea, but little attention has been paid to the question as to whether the total heat during normal waking hours, under daylight-saving, is greater or less than under the older time system. At first thought it would seem to be the same. It is well known, however, that the early morning temperature, as a rule, is lower than the average evening temperature. On this basis a good daylight-saving argument can be built up from the cooling standpoint.

The interval of time between two successive noons, which constitutes the solar day, is not perfectly uniform in length. Some peculiarities in the shape of the annual orbit, which the earth pursues around the sun, cause slight but appreciable inequalities in the length of the solar day. For this actual solar day, which is variable, custom has substituted an average or "mean solar" day, which is equal in duration to the average of all the actual solar days throughout the year. The accompanying diagrams are, therefore, based on what is called "mean solar time."

The daylight-saving law, as it was enacted by Federal statute in 1918 and 1919, and by State law and city ordinance in 1920, is illustrated in each diagram by the advancement of the clock one hour during the working hours of days in the months April to October, inclusive. The significant feature of these diagrams, which were prepared by the U. S. Weather Bureau, is the increasing number of daylight hours during the summer months for the farther north latitudes, as compared with the southern latitudes; and a corresponding shortness of daylight during the northern winter.

From this it is apparent that daylight saving is a matter of greater concern to cities and countries in the northern portion of the Temperate Zone, than to those in more southerly latitudes. The same is true in inverted order of localities in the South Temperate Zone.

But a vast majority of the industrial peoples of the globe have their habitat between the 40th and 55th parallels of north latitude. The census enumeration of 1920 shows that about half the population of the United States lives in the eastern time (75th meridian) zone, and that approximately 85% of the persons employed in that zone are engaged in industrial, commercial, financial and professional pursuits. Thus time in the affairs of men is a relative quantity. It must be adjusted to circumstances of place in both latitude and longitude.

The advancement of the clock half an hour in the latitude of 42°, described in the second diagram, would bring the working day in winter between the sunlight hours 7 a. m. to 4 p. m. In the latitude of 54°, third diagram, it would have to be advanced 1½ hours to effect the same purpose.

The permanent advancement of time one hour in each zone of time (75th, 90th, etc.,) would seem a reasonable solution of the daylight-saving problem. It would ultimately prove to be a move in the interest of humanity and of human productivity, and avoid the confusion that is inseparable from the alternation between summer and winter time.

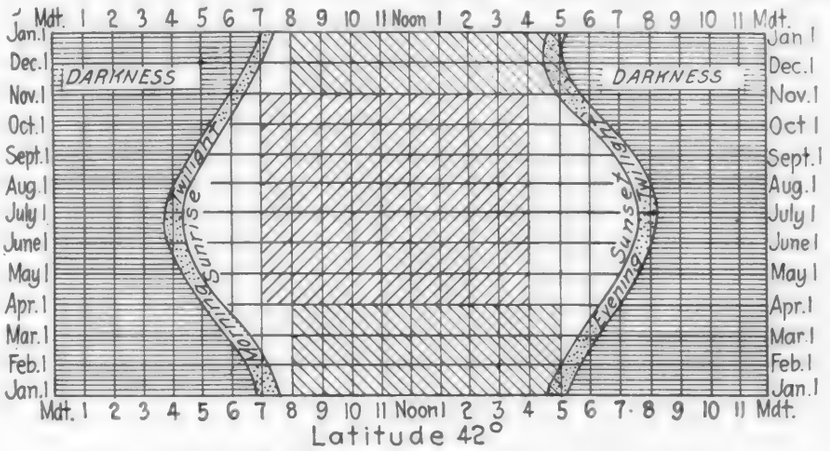

FIG. 2. HOURS OF SUNLIGHT AND DARKNESS ALONG THE PARALLEL OF 42°, NORTH LATITUDE.

This latitude passes near Salt Lake City, Omaha, Chicago, Cleveland, and Boston; and in Europe, near Bordeaux and Venice. Duration of winter day, 9 hours and of summer day, 15 hours.

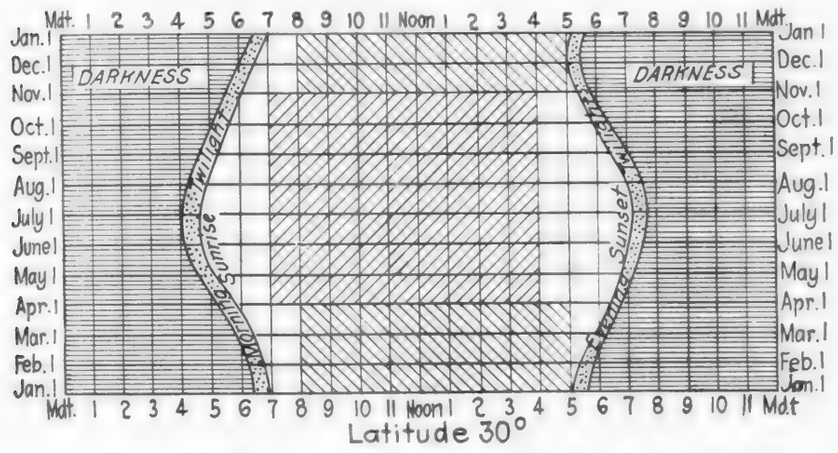

FIG. 1. HOURS OF SUNLIGHT AND DARKNESS ALONG THE PARALLEL OF 30°, NORTH LATITUDE.

This latitude passes near Galveston, New Orleans and Jacksonville. Duration of winter day, about 10 hours and of summer day, 14 hours.

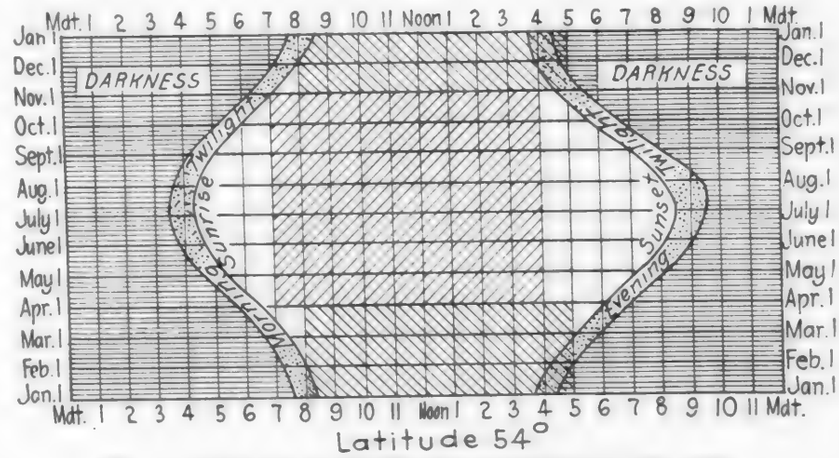

FIG. 3. HOURS OF DAYLIGHT AND DARKNESS ALONG THE PARALLEL OF 54°, NORTH LATITUDE.

This latitude passes through central portions of Canada to Labrador; thence to Liverpool and near Hamburg and Berlin. Duration of winter day, 7 hours and of summer day, 17 hours.

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ONE of the easiest things to get started these days is an argument on ventilation. Men otherwise well-balanced and cautious in their expressions will spring to the rescue of their pet theories on this subject with an enthusiasm worthy of an old-time religious discussion. And yet the present generation of heating engineers has more than once had to swallow its pride and virtually admit that its practice was at fault or, at least, in need of drastic revision. All this was demoralizing enough, but when the time came that the experts themselves were unable to agree on the newer theories, then indeed the industry was brought face to face with a difficult dilemma. It must be said for the fan manufacturers that they have never wavered in their staunch championing of the "central fan system," and whatever new principles or applications were evolved, no opportunity was lost to demonstrate that the central fan system was adequate to meet the requirements.

At the very time when the opponents of accepted practice in mechanical ventilation were delivering their most telling blows, two events may be singled out as going far to crystallize the New Thought on the subject. One was the ingenious Synthetic Air Chart method of determining good ventilation, which will long mark the impress made on the art by Doctor E. Vernon Hill. The other was the rebirth of the unit blast heater idea. On these two factors hangs much, if not most, of the laws of recirculation and the prophets of smaller units in ventilating work. We might mention ozone as a third factor, but this is a later development and there will be time enough to determine its status in ventilation when it has had a more extended trial.

What has transpired, say, during the past ten years, is epitomized very clearly in the thoughtful summary of the situation presented in these columns last month by the chief mechanical and electrical engineer of the Office of the Supervising Architect, U. S. Treasury Department. No man's judgment, even yet, may be considered final in the classic discussion of mechanical ventilation and this fact is emphasized in the comments aroused by Mr. Thompson's paper. But the fact remains that Mr. Thompson's presentation is that of a practical man facing the situation as it exists and it is altogether likely that his comments will have a profound influence in helping the profession to adjust its ideas to these facts.

LESS than a year ago the point was advanced by one fan manufacturer that engineering papers were not adopting a proper attitude towards manufacturers of ventilating equipment by "exploiting" the unit heater in comparison with the central fan system. Manufacturers of unit heaters and similar apparatus, it was maintained, are prone to characterize the central fan system as "out-of-date and of worthless design." This attitude seems to be an accompaniment frequently attending the development of any radical variation of accepted practice. In their zeal some of the unit heater advocates have drawn the deadly-parallel simile with scant regard, it must be admitted, for the sensibilities of the old-line fan manufacturers.

But what has happened? Where, ten years ago, the types of unit heaters could be counted on the fingers of one hand, today we see them multiplied until nearly all of the leading fan manufacturers are equipped to supply them on demand. Indeed, so significant has become the growth of unit heaters, especially those of the fan blast type, as to constitute a distinct epoch in the industry. What it all means may not be clear at this time, but it is certainly a factor to be reckoned with and a journal which purports to represent the industry and fails to take cognizance of their existence could hardly escape the stigma of narrow-mindedness.

Such being the case, a responsibility devolves upon the exploiters of the unit blast heaters, no less than upon the advocates of other methods, to meet the questions very properly raised as to the capabilities of their apparatus, the principles applied in their design and any other information that will lead to a correct appraisal of their usefulness. Let us look at all the facts, to the end that a correct judgment may be formed as to the place these appliances should occupy in the ventilating field.

In an effort to throw as much light as possible on the matter, a series of articles will be presented in these columns, commencing next month, dealing specifically with the different types of unit heaters now on the market, and including as much information regarding each type as can be obtained, to enable the engineering world to determine how far these units fit in, not with the Old Thought or the New Thought, but with the Best Thought in the practice of ventilation.

CORRESPONDENCE

"Where We Are At in Present-Day Ventilating Practice."

The leading article in your issue for April, by Nelson S. Thompson, chief mechanical and electrical engineer in the Office of the Supervising Architect, U. S. Treasury Department, is one which is bound to create discussion, in view of the conclusions which Mr. Thompson reaches and the importance which will be placed on his message, in consideration of the fact that he has for some time been responsible for the design of all ventilation schemes used in Federal Buildings for which the Supervising Architect's Office is responsible.

Some of Mr. Thompson's arguments are excellent, but his quotations are frequently unfortunate for the impression they convey, and would bear some investigation.

The faddists we have always with us, but why give their outbursts any more consideration now than heretofore? Mr. Thompson, we assume, quotes without responsibility, which is a dangerous thing to do when quoting from people who have started out to prove something and are not hampered by facts.

For example, much is made of Report No. 68, published in February, 1918 by the Department of Health of the City of New York, being a report on "Class-Room Ventilation and Respiratory Diseases Among School Children," by Dr. S. Josephine Baker, director, Bureau of School Hygiene.

The advocates of open-window ventilation have been using this report for some time back in undertaking to prove the fallacy of mechanical ventilation, and as a result, it has been fully brought out that if these tests prove anything, it is the necessity of better supervison, or of a law compelling the operation of the ventilating systems provided in public schools, whether mechanical or otherwise. It has been reported on the best authority that the mechanically-ventilated schools on which this report is based were not the latest, or even recent examples of the art, and that there were no steps taken to see whether the fan ventilating systems were properly operated at the time, or, in fact, that they were operated at all.

Personal observations in schools of New York City, and unfortunately of other cities, make it very doubtful if these systems were in more than occasional operation. Dr. E. Vernon Hill, who is also freely quoted by Mr. Thompson, took issue with the conclusions of Dr. Baker's report, in an article in the November, 1918 issue of THE HEATING AND VENTILATING MAGAZINE.

THE DETROIT SCHOOL TESTS.

On the other side of the argument is the test made in Detroit on two duplicate school buildings between open-window and mechanical ventilation, with each one operated to the best possible advantage, and which showed results clearly in favor of fan ventilation.

Mr. Thompson quotes Dr. Geo. T. Palmer, of the Detroit Department of Health, whose conclusions are based on this same study which Dr. Baker's report covers. Dr. Palmer disregards the results of the test in the Detroit schools, and the fact that the Board of Health, of which he is a member, approves the fan ventilation system as used in Detroit.

CONTROL OF VENTILATING BY TEACHERS.

The writer agrees with Mr. Thompson that the teachers in our public schools, particularly in the grade schools, are almost sure to express criticisms of the standard fan-blast type of heating, with automatic temperature control, but should we take this as competent evidence? Is not this attitude largely psychological? Here is a teacher of more or less sedentary habits in a room with 40 or 50 young and active children. Who should be considered, the teacher, or the children? Can you imagine the results if the temperature, humidity, and air circulation of a dozen school rooms were left solely in the hands of as many different teachers?

The nature of the profession is such that each teacher has a tendency to become autocratic, and things with which she is concerned, but which are beyond her control, are quite apt to be the subject of criticism. Unfortunately, criticism of the operation of mechanical ventilating systems in practice is too often merited, but the remedy lies in preventing by public sentiment backed by law the neglect and disuse of ventilating systems.

TEACHERS AS INSURANCE RISKS.

Another quotation is from Dr. William E. Watt, in the "Nation's Health," to the effect that "Few teachers—very few—are sound after 20 years in school air.—Life insurance companies put teaching down as a hazardous occupation, next to saloon-keeping and marble cutting." Recent inquiry of the actuaries of one of our largest insurance companies failed to disclose that the last statement is true. What proportion of teachers are sound after 20 years of teaching I do not know, and I wonder on what authority Dr. Watt makes his statement, but whether the unsoundness is due to the quality of air, or to something else, would be difficult to prove. Dr. Watt, I am informed, has something to sell, a so-called system of school ventilation, which combines open windows with other features.

Mr. Thompson points out that the pupils are in the classrooms only about 850 hours out of a total of, say, 6000 hours in the school year, and questions the wisdom of providing theoretically perfect conditions for this small portion of the time, in the hope of benefiting the child. Is it not strange that this same small proportion of the time should so seriously affect the teachers?

USE OF AIR WASHERS IN RECIRCULATING AIR.

Another quotation is from tests of recirculated air made by Professor G. L. Larsen. (See Journal American Society of Heating and Ventilating Engineers, October, 1915.) Among Professor Larsen's conclusions in reference to the use of an air washer, was that when air is recirculated within a building, the air washer absorbs a considerable amount of carbon dioxide. Another was that the air washer is quite efficient as a dust remover, but does not remove bacteria, and a third result is that with outside temperatures averaging around 30° F., a relative humidity of 60% in the rooms caused no trouble with condensation on the walls and windows at a room temperature of 65° F.

These results do not agree with more recent data, probably on account of the improvement in the design of instruments for such work. Perhaps Professor Larsen would prefer to correct them now. With single sash and indoor temperature of 65° F., with 30° F. outdoors, the highest relative humidity which would not cause condensation on the windows would be 55%. Carbon dioxide gas is soluble, but with recirculated water, the saturation point would soon be reached. There are a number of very authentic reports on the efficiency of an air washer as a bacteria remover. I will quote only Dr. E. Vernon Hill's statement in the Journal of the American Society of Heating and Ventilating Engineers of March, 1922, page 244 "We find that the reduction in the number of bacteria coming from a washer is usually proportional to the reduction in dust—in a properly-designed washer we get a reduction perhaps of 90% under standard conditions, and in the bacteria removal possibly the same amount."

With most of Mr. Thompson's own conclusions the well-informed ventilating engineer will have no quarrel. It is rather with the indiscriminate use of published statements

which are supported by insufficient data and the failure to emphasize the real point, which is that no ventilating system can be effective unless used. We will all agree with Mr. Thompson that open-window ventilation is adequate for any apartment not occupied more densely than one person in 1900 cu. ft. of space, providing, of course, that there is no machinery or process which sets up conditions requiring something more effective. Mr. Thompson evidently offers the direct-indirect system for heating school rooms as a less effective, but cheaper one than the split system with direct radiation and fan ventilation. The conclusions of Dr. E. Vernon Hill's report in the January issue of THE HEATING AND VENTILATING MAGAZINE, are unfavorable to this opinion. Mr. Thompson states certain conditions which he considers can be obtained during 70% of the heating season with a direct-indirect system if properly operated. Certainly these conditions may be obtained during 100% of the heating season in a mechanically-ventilated school, with less attention, and with greater certainty.

C. A. BOOTH,
Vice-President, Buffalo Forge Company.

Buffalo, N. Y.

Distinctions in Air Conditioning Patents.

EDITOR HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for January there is an article on "Novel Scheme for regulating Humidity in Airplane Propeller Factory," by A. C. Knauss, assistant engineer of the U. S. Forest Products Laboratory. It will no doubt be of interest to you and your readers to know that the scheme or system of humidity control outlined by Mr. Knauss is covered by U. S. patent 854270, dated May 21, 1907, and is the property of the Buffalo Forge Company. This patent has always been known as the "dewpoint method of humidity control." The following brief excerpts of the claims suffice to show the nature of the patent:

" . . . method of regulating the absolute humidity of the air, consisting in spraying into the air, water heated to a temperature above that of the air and below the boiling point, separating the free water from the air and regulating the temperature of the water by means controlled by the temperature of the humidified air."

And also a . . . "method of regulating the relative humidity of air, consisting in saturating the air with vapor by causing an intimate contact of the air with water—regulating the temperature of the water by a thermostatic device influenced by the humidified air, and then changing the temperature of the air."

This patent, you will note, covers essentially the same method as outlined by Mr. Knauss. There is nothing new or novel about the dewpoint system of humidity control. We and our associates, the Carrier Air Conditioning Company of America, have been using this method for fifteen years. Due to the broad nature of the claims, as well as those of other patents covering air washers, humidifiers and dehumidifiers, we have been successful in establishing the largest air conditioning business in this country.

The dewpoint control patent has been broadly sustained in our higher courts. We believe that the impression conveyed in Mr. Knauss's paper should be corrected, at least so far as novelty of the method is concerned. The control of relative humidity in a factory, a public building or a dry kiln by the control of the absolute humidity at a predetermined temperature is undoubtedly the simplest possible means of obtaining this essential result; it has been extensively and continuously advertised and used by this company, and infringements have been successfully prosecuted in the U. S. courts.

BUFFALO FORGE COMPANY.

Buffalo, N. Y.

In a communication received from Carlile P. Winslow, director of the Forest Products Laboratory, in Madison, Wis., regarding the foregoing, he states:

"We have known of the Carrier patent to which you refer (U. S. No. 854270) for a number of years. It was, in fact, in Mr. Tiemann's mind when he drew up the specification for United States patents 963,832 of July 12, 1910, and 981,818 of January 17, 1911, both of which were issued to him and dedicated to the public. The mechanism described in Mr. Knauss's article operates under these patents and does not, we believe, infringe the Carrier patent since the water used in the operation is always cooler than the air coming in contact with it, whereas in all of Mr. Carrier's claims it is specifically stated that the water is to be hotter than the air coming in contact with it.

Efficiency of Injected Blasts for Inducing Air Flow.

EDITOR HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for March, 1922, you have an article on Page 40 by Mr. Thomas Chester, discussing induced air flow by injected blasts. In this article he infers that an efficiency of 50% can be secured from the Venturi type of ejecting chamber. I should like to ask what is his basis for making this statement. I know that some tests were run by one of the men connected with Henry L. Doherty Co. some years ago and an efficiency of 3% was found. I have recently had a series of tests run myself and find that this figure of 3% may be bettered slightly, but only by a few per cent, and this has been confirmed recently by reports of some further tests.

Our experiments indicate that the method of handling air by means of injected blasts is an extremely inefficient one and its use should be discouraged in every possible case. I thought that you would be interested in having this called to your attention.

A. G. CHRISTIE.

Johns Hopkins University,
Department of Engineering,
Baltimore, Md.

In regard to the remarks of Professor Christie, it should be pointed out that the efficiency of a portion only of the equipment is referred to when it is stated that an efficiency of 50% can be obtained with the complete outfit. The statement is made also that 50% would be somewhat high for a mixing chamber or Venturi orifice. From the example given it is recommended that the injected blast be 40% in excess of the induced current, or exhaust capacity, required.

The static pressure of the injected blast was given as three times that of the induced current. Multiplying 1.4 by 3 gives 4.2, that is to say, the injected blast is intentionally figured at 4.2 times the energy of the induced current.

On this basis and allowing the efficiency of the fan handling injected air as 70%, an overall efficiency of 16.7% is found to be obtainable with a well-designed outfit. If the apparatus used by Professor Christie was only capable of giving an efficiency of 3%, he would likely find it of benefit to try some experiments with apparatus designed according to the sketch which accompanied the original article.—THOMAS CHESTER.

Explains Steam Heating Service Charge.

The Illinois Public Utilities Commission points out that the service charge which each consumer pays to a steam-heating utility, when added to that which every other consumer pays, will give a total that is equal to the fixed charges on the property devoted to steam-heating service. The service charge does not pay anything toward the upkeep of the system, for this expense is included in the rate fixed for steam sold.

CHATS WITH UNCLE BEN

Chimneys.

Uncle Ben came to the annual meeting of the heating engineers in New York and I had breakfast with him one morning at the Pennsylvania. He says out his way just now everybody thinks we are having hard times. Uncle Ben says it is a state of mind before it is a condition. "The world is going right along—people are being born and people are dying—people are eating and people are wearing clothes. Old fellows like me remember back in the years 1900-1914 when the fellow who got anywhere in the heating business was down at 7:30 in the morning and stayed until 6 P. M., and often until 11 P. M. That fellow won out when he did win out, by hard work and by having and using brains above the average level of his competitors."

Uncle Ben says he believes he has proved personally that a normal man, willing to work and save, standing on his own bottom, has just as good a chance today in this country as he ever had, maybe better. "The first fellows who cut out the easy hours—big profit—high overhead—no competition ideas of the war time, will be rewarded," says Uncle Ben.

Then the old man got to talking about his four sons, Sherman and Grant, Lee and Jackson. The old man gave each boy a home as each one grew up. I'll let him tell the story.

"The house I gave Sherman had a chimney 60 ft. tall, lined with glazed tile and tight as a drum. I put a strainer-type boiler in that house—I mean one of those that have a rather small grate surface burning at high speed, with a large fuel-storage capacity and an ultimate down-shoot to the chimney, which seems to cause the heat to stay in the fire and strain off the rather cool products of combustion. Sherman, the oldest and first to leave me, sure did brag about that boiler, and I guess it was a pretty good job, because he generally burns only 12 tons of coal.

"Then came along Grant, and he had to have a bungalow, and the boy spent so much on the lot that we rather skinned the house and had only a 30-ft. brick, plastered chimney with 4-in. walls. Of course he was sold by Sherman on the efficient strainer-type boiler. But the job proved to be anything but efficient! Sherman and Grant scrapped all winter about it. Grant burned something like 10 tons of coal and couldn't keep warm. He claimed that he couldn't burn enough coal to get warm, so they added some sections to the boiler. Then they complained of coal gas in the house, and every cold snap Grant and his little bride came over and stayed with Papa. I figured maybe we'd have to do something about it if they should catch a baby in that house.

"So when Lee got married nothing would do but that the Sherman boiler was condemned, and though his house was just like Sherman's and had a good chimney, he put in one of these boilers with a great big grate, an inverted bridge wall and mighty little heating surface between the grate and the chimney. Lee claimed that Sherman's job must be a fluke because it didn't check up against the same boiler in Grant's house, so he'd try this widely-advertised new boiler, especially as he could buy more catalogue rating for the same money.

"Well, Lee burned between 24 and 25 tons of coal, and complained all winter about being cold. His wife and the hired girl were both worn out, come Spring, from chasing down cellar to tend the fire. Lee also added some sections until his rated boiler capacity was double the actual radiation, and it became still harder to keep the grates under the inverted bridge wall from leaking cold air.

"Then little Jackson brought his troubles to me and we talked it over together. When his modest bungalow was built we finally got wise to the fact that primarily, if we would heat something we must arrange to burn enough fuel. If we have too much heat-absorbing surface for the chimney we can't burn enough fuel to heat the absorbing surface and get into other troubles, and if we don't have enough heat-absorbing surface to correspond with the chimney, we burn too much fuel and get into still other troubles.

"Jackson and I decided that for the low chimney of his little house we ought to use an up-draft boiler with little resistance to the flow of the gases, even though it should be rather deficient in heat-absorbing surface. Last winter Jack pulled through on 7 tons of coal, and his home was warm and happy all the time.

"I am having Lee and Grant trade boilers this summer, at the same time leaving out the extra sections which they have found didn't help. We think we have solved the boiler troubles for the family, and I pass it on for what it's worth.

"You get the draft pressure your chimney will tote and you buy your boiler accordingly. No boiler that I have ever heard of is equally good for different drafts or fuels. The very thing that makes it good for one condition condemns it for another condition. I am also about ready to say in a very general way that any combustion chamber which is best for coal is therefore not best, or probably even tolerable for gas, and any boiler tolerable for gas is probably far from desirable for oil. Don't make any mistake about that."

LEGAL DECISIONS

Heating Utilities Cannot be Compelled to Operate at a Loss.

The Supreme Court of the United States has held that a State has no power to compel a corporation, engaged in operating a public utility, to serve the public without a reasonable compensation. If the corporation is required by any act or proceeding to devote to the public the use of its property without compensation, it has been deprived of its property and of the equal protection of the law. When a public utility corporation is engaged in furnishing to the public through various departments of its business different kinds of service, it cannot be compelled to carry on a branch of its business which furnishes one kind of such service at a loss, even though at the same time its whole business may be conducted at a profit.

The Illinois Supreme Court applied these principles in the case of McCarmel Public Utility & Service Co. v. Public Utilities Commission, 130 N. E., 693, where the company appealed from the dismissal of its petition for permission to abandon its heating service in the city of McCarmel. The company, though authorized by its charter to furnish heat to the public, was not bound to do so. Having engaged in that service, it became subject to the supervision of the Public Utilities Commission, as provided in the Public Utilities' Act.

The evidence taken by the Commission indicated that the heating plant was practically worthless; that to enable it to render satisfactory service during the season would require substantially its entire reconstruction, at an expenditure of $100,000—an amount equal to the value of the plant—and that the plant would not then pay for its operation and any return on the investment. It was held that such a condition would justify the company in abandoning the service. It was held that an order requiring the company to operate the plant temporarily while an investigation was pending might have been made, but that an order without investigation by the Commission was not reasonable, but amounted to requiring the utility to devote its property to the public use without regard to compensation. The cause was therefore remanded for a further hearing by the Commission.

SERVICE DEPARTMENT

A Water Heater Problem.

QUESTION: We have installed a heater rated by the makers to deliver 2000 gal. of water per hour at 180°, using sufficient steam at 30 lbs. pressure. The heater has storage capacity of 1000 gal. and contains a coil of copper U-tubes (about 20 tubes) with a 5-in. steam inlet bushed 2½ in. and usual drip for return to boiler.

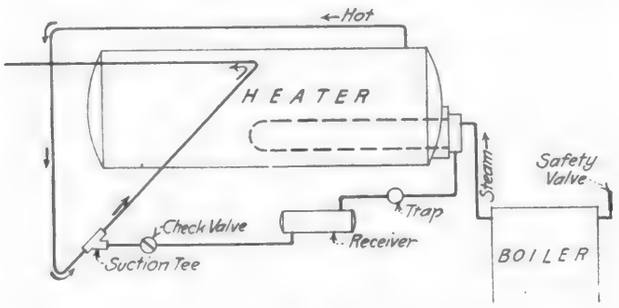
We have located bottom of heater about 2 ft. above water-line of boiler (50 H. P.) with air valve and vacuum breaker on steam chamber. We rely on the air valve to free heating surface from air, and on vacuum breaker to admit air so that condensation may flow by gravity to boiler.

We burn about 4000 lbs. of coal per 40 hours or about 100 lbs. of coal per hour, but cannot get anything like full rated amount of hot water from heater. With steam valve in line to heater open wide, we cannot maintain 30 lbs. pressure on the boiler.

Is the elevation of the heater above the water-line great enough to secure gravity return of condensation to boiler? At what steam pressure should the best results be expected? Should a larger or smaller steam inlet be provided? How many gallons of water should we secure at 180° with steam generated by burning of 400 lbs. of coal per hour?

We have another steam outlet on opposite side of boiler also 2½ in. Would you advise connecting this also to 5-in. steam inlet to heater?

Inasmuch as large quantities of water are drawn at about 50 lbs. pressure for washing purposes it has been suggested that



ARRANGEMENT OF WATER SERVICE HEATER WHICH DOES NOT MAINTAIN RATING.

better results would be obtained and tubes kept free from condensation if condensation were taken from receiver and discharged through a suction tee to hot water line flowing to washers. The doubtful element consists in the question as to whether or not the hot water under city pressure (50 lbs.) passing through suction tee would pull condensation from receiver and elevate it about 8 ft. discharging to washers under no head except friction in pipe. This arrangement works perfectly where hot water and condensation after coming together at suction tee do not have to be elevated and where, as in one case, the elevation is about half that of the present installation. We look forward to your advice in the columns of your publication.

ANSWER: A heater rated by any reputable maker to heat 2000 gal. of water per hour taken from the main at the usual temperature, to a temperature of 180° F., would undoubtedly perform in accordance with its rating if properly connected and supplied with sufficient steam. Under normal conditions a heater designed for a 5-in. steam inlet should have a 5-in. steam supply pipe running to it, unless considerable drop in pressure, due to friction in the pipe line, is permissible. Apparently a 2½-in. pipe would conduct sufficient steam at 30 lbs. pressure to heat 2000 gal. of water per hour without the velocity being excessive and the pressure drop too great, if the return to the boiler were made mechanically. With the bottom of the heater, however, 2 ft. above the waterline of the boiler the pressure drop in a 2½-in. pipe line, with steam at 30 lbs. pressure, would be several pounds and in this case obviously condensation would not return to the boiler by gravity in a satisfactory manner.

Usually a 50 H. P. boiler, regardless of type, is not fired in the most economical manner, and to heat 2000 gal. of water per hour from 45° to 180° would require the burning of nearly 300 lbs. of coal per hour. If the correspondent burns only 100 lbs. of coal per hour, he can hardly expect to get much more than one-third of the rated capacity of the heater, assuming that the returns flow back to the boiler by gravity, leaving the tubes reasonably free from condensation so that a high efficiency will be passed from the steam in the tubes. Inasmuch as the heater has a condensing capacity nearly twice as great as the steam which can be supplied to it with the boiler in question, it is not surprising that 30 lbs. pressure cannot be maintained on the boiler when steam is flowing to the heater.

DIFFICULTIES IN RETURNING CONDENSATION TO BOILER.

It is doubtful if a satisfactory return of condensation to the boiler by gravity would be possible with a difference in elevation between the water-line of the boiler and heater in less than 30 ft., if the heater is operated with steam at 30 lbs. pressure. With the heater located 2 ft. above the water-line, probably the best-operating results will be obtained with a boiler pressure not exceeding 1 lb. on the boiler. In this case, however, the full 5-in. steam line should be carried from boiler to heater.

The correspondent's question as to how many gallons of water will be heated to 180°, presumably from city main temperature, with steam generated by burning 400 lbs. of coal per hour would be answered as probably about 2800. Evidently, however, the correspondent intended to use some other amount than 400 lbs. of coal per hour, as this does not check with any amount referred to elsewhere.

Undoubtedly the correspondent's inquiry as to combining both 2½-in. outlets from the boiler should be answered in the affirmative. It is evident from statements that the operating steam pressure is not maintained at 30 lbs. and is probably quite low. Under these conditions a steam supply larger than the 2½ in. originally provided is desirable. The two 2½-in. outlets from the boiler might be combined in one line 3½ in. or larger, running to the heater.

In regard to the use of a suction tee to eject condensation from the receiver, this method would undoubtedly be successful, providing the condensation in the receiver is not at a temperature so high as to vaporize at the lower pressure induced by the suction tee. Inasmuch as the heating element is much larger than required, doubtless the temperature of condensation is considerably below 200° and the suction tee should work to advantage in pulling the condensation from the receiver. Care must be taken, however, that no air leaks occur at or near the tee as it takes but a small air inlet to make a suction tee ineffective. Probably the least costly and satisfactory means of getting the return to the boiler would be through the use of a belt-driven boiler-feed pump.

The writer has seen suction tees, like that illustrated in the sketch, used successfully under similar conditions, but believes that it will fail to perform if condensation is too hot.

Hot Water Circulation in a Gravity Heating System.

QUESTION: I am told that where two radiators are connected above each other on the same risers on a water heating system, the water will circulate most rapidly through the lower radiators on account of the greater pressure of the water. Is this correct? It is contrary to theory I have studied. Why should the pressure affect the circulation? I am told that in a six-story building, difficulty was experienced in circulating water to the top floor because the high pressure on the lower radiators caused the water to short circuit through these radiators, even though passage to them was constricted.

ANSWER: There seems always to have been something verging on the mysterious as to just why water circulates in a water heating system; at least, mysterious things seem to happen and the explanations offered by many otherwise well-informed persons are very interesting, if not always instructive.

It will be interesting to digress for a moment and discuss just why the water does circulate. There are just two fundamental causes—phenomena we might say—that produce circulation in a gravity system. These two causes are the phenomena of expansion due to the rise in temperature of the water and plain old-fashioned gravity or weight, which is the measure of gravity.

There are, it must be admitted, a multitude of baffling and apparently complex disturbances and conflicts that rise up to perplex us, but if the investigator will keep clearly in his mind these two fundamentals and will come to believe that whatever troubles do arise can be reduced in the end to these two terms, half his battle will be won and his "hot water" troubles will be on a fair way toward solution.

THE PRINCIPLE OF HOT WATER CALCULATION.

Let us imagine the simplest circulating system of which we can conceive. Fig. 1 shows such a system in cross section. It is simply a circular tube or pipe with an enlargement at the top to serve as an expansion chamber. The system contains everything necessary for a circulating system with no complications to distract our thoughts. Suppose now we fill this system with cold water up to the line wl. Nothing happens, the water remains motionless and the surface or water line stands at wl. Now suppose we apply heat to that portion of the system between the points a and b. It is well known that water expands when heated and it would expand in every direction if free to do so. Being restricted by the tube it can expand upward and downward only. It will be fair to assume that the heated portion has expanded upward to A and downward to B.

We can assume that as yet no circulation has taken place. The total volume of water has increased but the increase in volume has occurred only on the left side of the circuit, that is to the left of the center line CC. This increase in volume must have been accompanied by a decrease in density or weight per unit of water heated. This loss of weight obviously is equal to the amount of water between the old and the new water lines in the expansion chamber or between wl and WL. Since the water on the right side of the circuit has not expanded, it must be heavier than the water on the left side by exactly this amount. We must, therefore, have motion or circulation in the direction indicated by the arrows until equilibrium is established or until the forces (weights in this case) on either side of the circuit have become equal. The water in the system will then come to rest. The force which produced

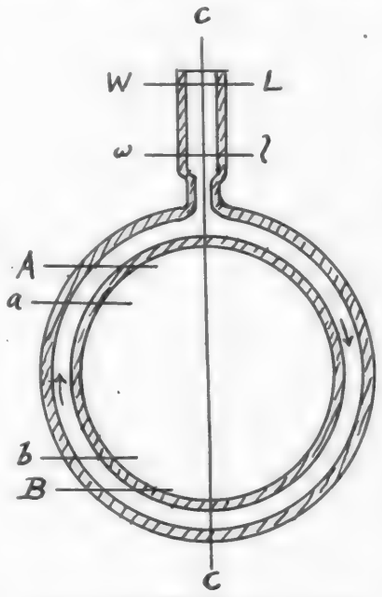


FIG. 1.—ILLUSTRATION OF PRINCIPLE OF HOT WATER CIRCULATION.

this motion is equal to the weight of water between the levels wl and WL.

Now if we assume that heat is applied continuously to the left side of the circuit as would be the case if a water boiler were inserted in this side of the circuit and at the same time assume that the water on the right side is continuously cooled as would be the case if we had several radiators on this side of the circuit, we shall get a continuous circulation.

APPLYING THE PRINCIPLES TO SPECIFIC PROBLEMS.

This all seems very trite and very simple and hardly necessary of demonstration. It is, however, fundamental for it gives the basic facts relative to the force which produces circulation in gravity water heating systems. It is interesting to note that the total volume of water in the system does not necessarily affect the force at work nor does it matter whether or not there is an equal volume of water on each side of the system. The important thing is the difference in pressure, at any given point, between the cold and hot sides of the system.

We are accustomed to say that circulation is caused by the difference in weight between the cold descending water and the hot ascending water. This is not strictly true, for as just stated the total weight of water in the system does not necessarily have anything to do with the force producing circulation. One special case where the difference in weight would be an accurate measure of the force at work would be the one shown in our simple circulating system. Practical systems, however, are not simple and so it will be more accurate to use the term 'pressure' or better yet 'force,' rather than 'weight.' The resultant force per unit of area which produces or tends to produce circulation or motion at any point in the system is due to height or head and the average temperature difference between the two sides of the system and nothing else.

The hottest water will be found at the highest points of the system, if it has a chance to flow there or if it is not forcibly prevented from getting there. The fact that there is more pressure on the lower radiators would of itself not affect the circulation. Water for all practical purposes is incompressible. Therefore 1 gal. of water under 1 lb. pressure is no different in its characteristics from what it would be under a greater pressure. The main effect of pressure on water is to raise its boiling point and as the water in a gravity water heating system should never be brought to its boiling temperature, the question of pressure need not, it would seem, affect the circulation.

There is one result of the increase of the boiling point due to increase of pressure which might be mentioned. The accompanying table gives the boiling points for different pressures and also shows the head of water which would produce this pressure. It is evident that if a building were of such height that the high point in the hot water system were 100 ft. above the boiler the pressure at the boiler would be 40 lbs. and the boiling point would be 287° F. The circulation in such a system might be very rapid, due to the possible unusual range in temperature and the consequent unusual force tending to produce circulation. There would, however, be no tendency for the lower radiators to circulate

BOILING POINTS OF WATER WITH DIFFERENT ATMOSPHERIC PRESSURES

Lbs. per Sq. In. above atmosphere	Equiv. Head in Feet	Temp. of Boiling Pt. in deg. F.
0	0	212
5	12	228
10	24	240
15	37	250
20	49	259
25	61	267
30	74	274
35	87	280
40	100	287
45	113	292
50	125	297
60	151	307
70	177	316
80	205	324
90	230	332
100	257	338

faster than the upper ones. What might happen is that this super-heated water might arrive at the top of the system before its temperature had been lowered below the boiling point at that decreased pressure, with the result that there would be boiling in the upper part of the system and a possible loss of water by this means.

Again, when trouble occurs in the circulation of a radiator or in a whole set of risers, the chances are good that the real trouble isn't at all where it seems to be but that some other radiator or set of risers possibly closer to the boiler and apparently manfully doing their duty, are to blame. They may be working too well. The circulation may be so rapid through them as to discharge water into the return main so hot that it will try to flow back up the return main *away* from the boiler and so throw out of balance some radiator or set of risers further along the line. A hot water system is made up of numberless unbalanced forces. If these forces all act together as they should, all is well. If they do not, the number of things that can happen is really astonishing. —WILLIAM F. DEVENDORF.

NEW DATA ON INTERMITTENT HEATING

Contrary to the accepted theory that there is no economy in shutting off heat in a building at night, the St. Joseph Heating Company of South Bend, Ind., in conjunction with the Heat Utilization Committee of the National District Heating Association, has been able to show a distinct saving on two buildings in which it has conducted tests. While these results might not be obtainable in all buildings and in some instances, such as residences, would not be practicable, they are illuminating in showing that many pet theories are not always borne out in practice.

The accompanying load curves give a very good idea of the steam consumption by continuous operation as compared with that when there is no steam on at night. Fig. 1 is a large department store and Fig. 2 an office building. The curves were obtained from demand indicators attached to the meters which registered the consumption in half-hourly periods, and it can readily be seen that there is very little if any peak when steam is first turned on. It must be borne in mind that the comfort of the occupants of the building was not impaired by turning off at night and that the saving amounted to over 50% in the first case and nearly 48% in the second, the outdoor temperatures being taken into consideration. While these savings may be exceptionally large, savings of 20% to 30% it is stated, are very common.

The resulting economy with steam turned off as indicated in the load curves is accounted for in part by the smaller heat loss at night, due to the lower average temperature of the building. Thus, if the building cools from 70° to 50° when the outside temperature is 20°, the theoretical heat loss will be about $\frac{60-20}{70-20}$ =80% of that which occurs when the building is maintained at 70° all night. The increase in the saving beyond this point, the company states, is due to the elimination of waste.

A building which is heated continuously is almost invariably overheated during the night and usually also during the day. Turning off steam at night prevents the overheating not only during the night, but also goes a long way toward preventing waste during the day as it teaches the operator of the heating system to watch the temperatures in the building and turn off the steam before the occupants start to open the windows. In other words, this method shows him the possibilities of economy and how to prevent in some measure the wastes which will otherwise occur.

The lowest outside temperature at which it is desirable to turn off steam entirely at night varies according to the construction of the building and also according to the amount of installed radiation in proportion to the heat loss. Generally speaking, it is safe to operate in this manner until the outside temperature drops 20° or 25°, while in buildings of very good construction and ample radiation, 10° to 15° oftentimes need not be feared.

Probably the best plan to follow at night is to never allow the temperature in the building to fall below some certain point as 50° or 55°. If there is a watchman, he can attend to this, if not, *a time-controlled thermostat* operating on the house valve will take care of it. Then the building can usually be brought up to 70° again in 3 or 4 hours.

It is surprising to note how slowly a building of considerable thermal capacity will cool with steam off, 2° per hour often being reached only in very severe weather. Frame buildings will, of course, cool more rapidly, but the drop is not excessive with outdoor temperatures of 25° to 30°.

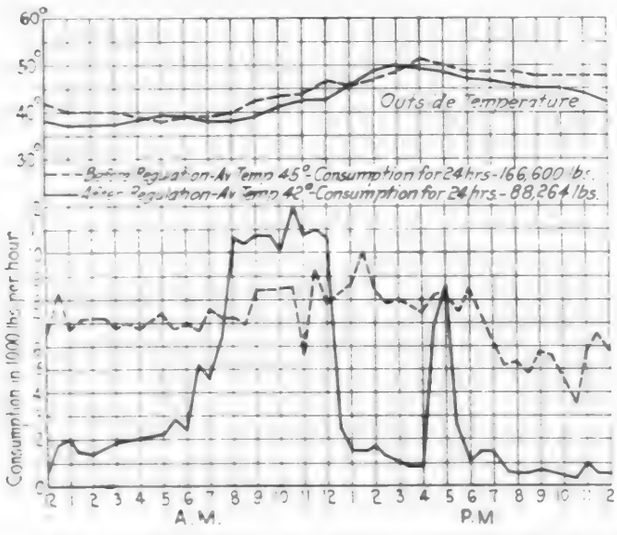

60°
50°
40°
30°
Outside Temperature
Before Regulation-Av Temp 45°-Consumption for 24 hrs-166,600 lbs.
After Regulation-Av Temp 42°-Consumption for 24 hrs-88,264 lbs.
Consumption in 1000 lbs per hour
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 2
A.M.
P.M.

FIG. 1.—LOAD CURVE FOR LARGE DEPARTMENT STORE WITH CONTINUOUS AND INTERMITTENT HEATING.

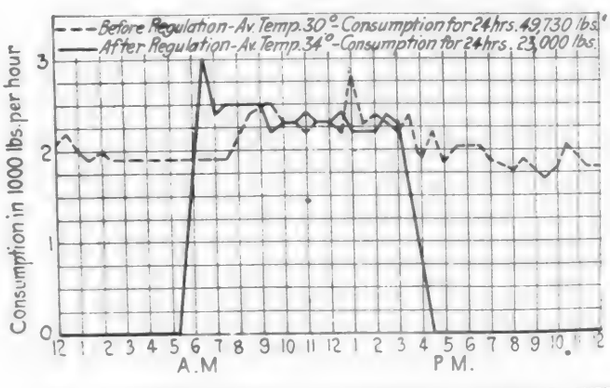

Before Regulation-Av Temp. 30°-Consumption for 24 hrs. 49,730 lbs.
After Regulation-Av Temp. 34°-Consumption for 24 hrs., 23,000 lbs.
Consumption in 1000 lbs. per hour
3
2
1
0
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 2
A.M
P.M.

FIG. 2.—LOAD CURVE FOR OFFICE BUILDING WITH CONTINUOUS AND INTERMITTENT HEATING.

Current Heating and Ventilating Literature.

Recent Fuel Investigations. Power Plant Eng. vol. 26, no. 3, Feb. 1, 1922, pp. 162, 164. Experiments conducted to determine feasibility of utilizing lower-grade fuels for steaming purposes. 20c.

An Analysis of Factory Heating, M. C. W. Tomlirson. Factory, vol. 28, no. 2, Feb. 1922, pp. 162-164, 4 figs. Twelve ways to get more heat from less coal. 40c.

STEAM

Fuel Economy by the Adoption of Scientific Management in Steam Generation and Utilization. David Brownie. Eng. & Indus. Management, vol. 7, nos. 2, 4 and 5, Jan. 12, 26, and Feb. 2, 1922, pp. 39-41, 6 figs., 117-120, 9 figs. and 131-132, 2 figs. Jan. 12: Boiler and pipe coverings. Jan 26 and Feb. 2: Steam traps. 40c. each.

VENTILATION

Ventilation and Human Efficiency Leonard Hill. Mech. World, vol. 71, no. 1830, Jan. 27, 1922, p. 69. Better health due to attention to good ventilation, and increase in efficiency and output due to cooling power adjusted to severity of work. Notes on electric and recording katathermometers. From paper read before Instn. Min. & Met. 60c.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Heating Engineers Two-City Meeting to Extend Over Six Days.

Heating men will make a solid week of it when they attend the forthcoming mid-summer meeting of the American Society of Heating and Ventilating Engineers, in Buffalo (June 5, 6 and 7) and Detroit (June 8, 9 and 10). Headquarters in Buffalo will be at the Hotel Iroquois and, in Detroit, at the Hotel Wolverine.

While the two cities will vie with each other in entertaining the visitors, one of the principal features of the whole affair will be the boat trip from Buffalo to Detroit, on the night of the 7th. The trip will be made on the steamer Detroit III, of the Detroit and Buffalo line. The Detroit III is the largest steamer on the Great Lakes.

In connection with the Buffalo entertainment program, the festivities will begin with a theatre party for the ladies Tuesday afternoon, at Shea's Theatre, as guests of the Western New York Chapter. At 5:00 o'clock the same afternoon, the entire convention party will be taken in automobiles to the Buffalo Automobile Club for the informal dinner dance and entertainment. The club is about 15 miles out of Buffalo and is charmingly situated, with a large lawn where games of various kinds can be played. The clubhouse itself is well appointed and has an attractive ballroom.

An Wednesday, June 7, the ladies will be taken on the Niagara Falls trip, as guests of the Western New York Chapter. They will be entertained at luncheon at the Clifton House, Niagara Falls, and will then proceed as far as Youngstown where they will inspect the old fortress and other points of historical interest. The ride from Niagara Falls to Youngstown is described as one of the most beautiful in that section.

In connection with the boat trip from Buffalo to Detroit, on June 7, it has been planned to serve dinner on the boat. This will be followed by dancing and entertainment in the ball-room of the Detroit III and this event is being looked forward to with special pleasure.

Upon arrival in Detroit Thursday morning, a professional session will be held at the Wolverine Hotel. Other professional sessions are scheduled for Friday and Saturday mornings, but the afternoons of Thursday and Friday are to be held open for excursions to the public schools and to industrial plants. On Friday evening there will be a dinner-dance and entertainment at the Lockmoore Club. Finally, on Saturday afternoon, following adjournment, the members and guests will attend a league baseball game.

The full personnel of the Buffalo committee is as follows:

General chairman, W. G. Fraser.

Finance committee, L. A. Harding, Harry Davis, George Drake, W. A. Fenn and Fred Welder.

Transportation committee, Edgar Wendt, E. M. Case, E. L. Reinhardt, Scott Ross and F. W. Zander.

Reception committee, Warren Hillis, C. A. Booth, H. P. Dempsey, P. J. Dougherty and M. S. Jackson.

Registration committee, William Roebuck and W. Worsham.

Ladies' committee, Mrs. Frank, Mrs. Wadley, Mrs. Farrar, Mrs. Booth, Mrs. Jackson, Mrs. Farnum, Mrs. Love, Mrs. Reinhardt and Mrs. Soule.

Program committee, C. P. Wadley, H. F. Hutzel, G. Whittlesey, O. K. Dyer and C. A. Evans.

Hotel committee, F. B. Howell and C. W. Farrar.

Following is the full personnel of the Detroit committee:

General chairman, F. R. Still.

Organization, J. L. Fuller.

Information, J. F. McIntire (chairman), Frank Schuell, R. Collamore, F. DeBoos and William T. Harms.

Hotel and publicity, C. W. Locker (chairman), J. C. MacDonald and H. H. Hughson.

Finance, W. B. Johnston, C. M. McSorley and H. A. Hamlin (treasurer).

Acquaintance, E. L. Downs (chairman), E. M. Harrington, C. A. Blaney A. C. Pittelkow, J. W. Parlan, A. H. Williamson, S. B. Bryce, C. H. Carstans and J. E. McClure.

Automobile and transportation, N. J. Diebolt (chairman), J. H. Walker, E. Snell and R. S. M. Wilde.

Ladies, J. B. Dill (chairman), Mrs. Dill, Mrs. McIntire, Mrs. Hamlin, Mrs. Howe, Mrs. Johnston, Mrs. Collamore and Mrs. Still.

Entertainment, Frank E. Peckham.

One of the notable features of the Detroit meeting will be a visit in a body to the exhibit of the National Association of Master Plumbers whose convention will just be concluding as the Detroit meeting of the heating engineers gets under way.

Percy Nicholls Joins Research Laboratory Staff.

It is announced that Percy Nicholls, until recently in charge of the planning and research department of the Franklin Mfg. Co., Franklin, Pa., has joined the staff of the Research Laboratory of the American Society of Heating and Ventilating Engineers. Through his connection with the Franklin company, Mr. Nicholls has been in close touch with heat transmission problems. He acted as technical adviser for the Magnesia Association of America and represented the association in the work done by their fellowship at the Mellon Institute.

At the invitation of the Pennsylvania State College, he spent his last summer vacation at that institution, outlining a course of heat transmission investigation which included the development of a heat-transmission standard resistance plate. He is the author of a section on heat insulation of the Sterling Marine Handbook and will contribute a similar section to a well-known handwork handbook which will shortly appear in a new edition.

Mr. Nicholls is a graduate of the University of Leeds, England, entering the university with a number of scholarships to his credit. Afer graduation and a four-year shop apprenticeship course in mechanical engineering, he competed for a Sir Joseph Whitworth scholarship, considered the blue ribbon of engineering academic distinctions in the British dominions, there being only four available each year. Mr. Nicholls was one of the four successful candidates. He is a fellow townsman and boyhood friend of A. H. Barker, president of the (British) Institution of Heating and Ventilating Engineers, who obtained his Whitworth Scholarship in the same year. Mr. Nicholls came to the United States in 1897, first entering the electrical field.

Research Fund Drive Under Way.

Under the chairmanship of Thornton Lewis, of the society's Research Committee, the drive for funds for the support of the Research Laboratory of the American Society of Heating and Ventilating Engineers is going forward with the following chapter representatives in charge of their respective districts:

Philadelphia, John F. Hale; Kansas City, Mo., W. A. Russell; St. Louis; E. P. Bradley; New York, Alphonse A. Adler; Cleveland, O., H. M. Nobis; Minneapolis, Minn., H. E. Gerrish; Pittsburgh, Pa., Samuel F. Richards; Boston, Dan Adams; Detroit, Mich., J. L. Fuller; Chicago, August Kehm; Western New York Buffalo, N. Y., C. W. Farrar.

It is planned to complete the drive by June 1.

Changes in Society's Headquarters Office.

Announcement is made that I. C. Baker, who has been acting as assistant secretary of the American Society of Heating and Ventilating Engineers, has resigned to rejoin the engineering staff of the American Blower Company, of Detroit. He is succeeded by A. V. Hutchinson, formerly on the staff of *Sheet Metal Worker* and *Sanitary and Heating Engineering*, who will act as manager of publications.

Illinois Chapter Discusses Temperature Regulation.

With a record of attendance of 80 members and guests at the April meeting of the Illinois Chapter, at the Engineers' Club, Chicago, April 10, a full

evening was spent in the discussion of temperature regulation. George H. Blanding, of the Johnson Service Company, was in charge of the meeting, the other speakers being J. C. Hornung, F. W. Powers and C. N. Stedman, of the Fulton Company.

In presenting the subject of the evening Mr. Blanding reviewed briefly the history of temperature control from its inception about 1883. He traced the origin of the electro-pneumatic system. The first commercial thermostat, he said, was patented in 1890.

F. W. Powers, of the Powers Regulator Company, gave an authoritative account of the further development of temperature control, his father having been the patentee of the first thermostat in 1890. Mr. Powers drew extensively on his long experience in the temperature-regulation field, dealing principally with individual room control.

J. C. Hornung, who followed Mr. Powers, told of heat-control methods for use in buildings where the heat is supplied from an outside source. Mr. Hornung showed the usefulness of master controls in reducing the consumption of steam in such buildings by closing off the supply before it reached the radiators. In a typical case he showed that the house service valve, under master control, was closed 70% of the time without resulting in a lowering of the temperature of the building.

C. N. Stedman, of the Fulton Company, gave an interesting account of the manufacture of the expanding metal bellows used in the thermostat manufactured by his company and spoke, in passing, of its application to automobile water-cooling systems.

After the speakers had finished, moving pictures were displayed of the manufacture and operation of the Johnson system of automatic temperature control, in which animated drawings were used to show how the various regulators work.

Combustion and Steam Velocities Taken up by Western New York Chapter.

An illustrated address on "Combustion," by T. A. Marsh, chief engineer of the Green Engineering Company, East Chicago, Ind., was one of the features of the April meeting of the Western New York Chapter, April 4. The chapter met in the rooms of the Engineers' Club, at the Iroquois Hotel, which will be the registration quarters for the society's forth coming mid-summer meeting. Mr. Green devoted his address to combustion engineering and described with pictures the crude chain grates that were invented years ago, up to the present efficient chain apparatus now being used in the most modern boiler rooms. A number of architects were present who were interested in this topic on account of the large school buildings now under erection in Buffalo which will contain fair-sized power plants. Mr. Marsh answered a number of questions from the architects which addred much to the interest of the discussion.

Following Mr. Marsh, James A. Donnelly, of the Donnelly Systems Company, New York, addressed the meeting on "Critical Velocities and One-Pipe Systems."

Previous to the addresses, President Farrar reported that all the important committees for the mid-summer meeting of the society had been selected with W. G. Fraser as general chairman. Mr. Fraser then presented a list of all of the sub-committees and the chairmen of each.

It was evident from the reports presented that the Western New York Chapter is planning a meeting that will long live in the memories of those so lucky as to be present.

Dean Anderson Guest of St. Louis Chapter.

A visit of Director F. Paul Anderson, of the heating engineers' Research Laboratory, to the St. Louis Chapter of the American Society of Heating and Ventilating Engineers, April 13, was made the occasion of a joint meeting of that chapter with the St. Louis Chapter of the American Institute of Architects. Sixty-seven members and guests were present when President Sodemann called the meeting to order after a dinner at the City Club.

Following a novel entertainment in connection with the demonstration of a radio outfit by Walter Kreisler, Past President E. P. Bradley addressed the meeting on "The Relation Between the Architect and the Heating and Ventilating Engineer." Mr. Bradley spoke at length on the importance of co-operation.

A response was made by Mr. Rathbone, president of the St. Louis Chapter of the American Institute of Architects, who prefaced an interesting and amusing talk with the statement that all the heating and ventilating plants with which he had any connection were giving perfect satisfaction as they were all shut down for the summer.

Mr. Rathbone assured the chapter that co-operation was needed and was invited by the architects and he stood ready to do anything in his power to promote any movement for the benefit of the two professions.

Mr. Hallett was called upon to introduce the main speaker of the evening, Director F. Paul Anderson. After paying a tribute of love and respect to the late Director Allen, Mr. Hallett introduced Dean Anderson as a man eminently fitted to carry on the work along the lines laid down by Dean Allen.

Dean Anderson began by thanking those present for the reception tendered him and soon had his hearers in a jovial frame of mind by a few stories pertinent to his subject. One of the facts upon which Dean Anderson laid special stress was that the Research Laborority would not try to determine the relative values of any devices, but was working along lines to investigate and collect data, and to establish standards for the application of the principles to be employed in developing devices. The speaker then showed the unlimited possibilities open to research and stated it was beyond the imagination to realize where the final result would lead. All will be benefited, however, by the discoveries and he instanced the development by the laboratory of the chart showing the cooling power of air under various conditions of temperature, relative humidity and velocity. As a result of this particular investigation, he said, the Government Medical Department is now engaged in extensive experiments on the effects of various temperatures and humidities on the organs and skin of the human body, both naked and clothed. Investigations will also be carried on in industrial plants to determine the conditions under which the greatest efficiency can be obtained. Dean Anderson also described the work of the laboratory in devising a code for the testing of fans and blowers, and the work done to determine the infiltration of air into buildings. Two of the most important subjects under consideration, he said, are the transmission of heat through building materials and the combustion of fuel in house-heating boilers.

Following his address, Dean Anderson answered a number of questions which were asked regarding the work of the laboratory. At the conclusion of the meeting he was given a rising vote of thanks.

New York Chapter Elects New Officers.

A novel program was offered at the April meeting of the New York Chapter, at the Building Trades Club, New York, April 17, in the form of a problem in house heating which those present were asked to solve. Plans had been prepared, and submitted in advance to the members, of a two-story frame house in which it was proposed to install a vapor heating system. After the subject had been presented by William H. Driscoll, the chairman of the evening, six designs were submitted, together with the calculations.

In order to center the discussion on some particular point, Mr. Driscoll took the plan of the living room of the house and listed the radiation as figured on each of the six plans. This varied from 64 sq. ft. to 92 sq. ft., and immediately started a lively discussion. Each of the six "contestants," so to speak, were called upon to discuss their layout. The first to take the floor was Charles V. Haynes, followed by Miss Helen R. Inniss and Messrs. M. W. Hook, Grill, Harding and Parker.

At the close of the discussion on this room, Chairman Driscoll took up the boiler and pipe sizes selected, together with the total radiation figured. This brought forth another storm of comments and the discussion lasted until a late hour.

W. G. Turno, chairman, presented the report of the nominating committee, and on ballot vote, the following were elected for the ensuing year:

President, W. H. Carrier; vice-president, W. L. Durand; treasurer, F. E. W.

Beebe; secretary, E. B. Johnson. Board of governors; A. S. Armagnac, W. J. Olvany and B. K. Strader.

New York Chapter Hears Address on Elimination of Waste.

Samuel E. Thompson, who was a member of the Hoover Committee of the Federated Engineering Societies, and who prepared the section of the report which covered the construction industry, was the principal speaker at the March meeting of the New York Chapter, which was held in the rooms of the Building Trades Club, March 30.

Mr. Thompson, who was introduced by Champlain L. Riley, gave a thoughtful presentation of this waste, which, as he stated, is a subject so vast in its possibilities that even the engineering public has not fully awakened to its importance. He suggested as the three main channels of investigation, (1) regularity of employment, (2) removal of labor restrictions, and (3) introduction of improved management methods. Under the first heading Mr. Thompson spoke of seasonal work, which was formerly regarded as dependent upon the elements but which, he said, is now being worked out more systematically. He also offered suggestions for continuing construction work in cold weather. Contractors must prove, he said, that they can carry on work in winter and they must be ready to meet the additional cost this involves by accepting reduced profits. At the same time labor, he maintained must accept reduced wages.

The worker, said Mr. Thompson, must learn that his interests and those of his employer both lie in greater output and to this end he suggested bonus payments or similar means to induce the worker to put forth his full productive power.

A number of important announcements were made at the meeting, including the appointment of Alphonse A. Adler as chairman of the chapter's Research Fund Drive. Secretary J. E. Bolling made a stirring appeal for support of the society's new publication, the *Guide*, stating, among other things, that it would contain an exhaustive compilation of data, in addition to those authorized by the society. Much of this information, he said, would be furnished by individuals or firms. Mr. Bolling characterized this as one of the *Guide's* most important features. He urged the members present to co-operate by furnishing names of prospective advertisers. As a result of his appeal, he was fairly flooded with responses in the form of prepared slips which were handed out and filled in as he was speaking.

President Armagnac announced the appointment of a nominating committee, consisting of Edwin A. Scott, W. G. Turno and George G. Schmidt.

A report of the entertainment committee of the chapter in connection with the annual meeting of the society, which was presented by Chairman J. E. Bolling, contained detailed figures of the committee's operations, accompanied by suggestions for future committees. One of these was that two or three additional rooms be reserved at the headquarters hotel where baggage could be delivered until rooms had been secured.

Speaking for the national Membership Committee, Charles V. Haynes told of the new chapters that had been formed or were in the process of being formed in Denver, Seattle, New Haven, Baltimore and Toronto.

Organization of Colorado Chapter.

Colorado heating engineers to the number of 15 have organized the Colorado Chapter of the American Society of Heating and Ventilating Engineers, with the following officers: President, F. H. Willis; vice-president, Leonard Michael; secretary, J. H. Daly; treasurer, Howard H. Fielding. Those present at the organization meeting were: George Bradbury, F. S. Cullyford, J. H. Daly, Howard Fielding, A. S. Meyring, Leonard Michael, H. E. Purcell, Joseph F. Pfeiffer, A. G. Rueler, C. O. Voight, O. G. Ward, A. Wallace, J. F. Wallace, H. W. Whitten and F. H. Willis.

ANNUAL CONVENTION OF NATIONAL WARM AIR HEATING AND VENTILATING ASSOCIATION

Approval of a proposed warm-air furnace installation code and an announcement that the warm-air furnace research work at the Engineering Experiment Station of the University of Illinois, was nearing completion, were outstanding features at the ninth annual convention of the National Warm Air Heating and Ventilating Association, which was held in Cleveland, O., April 19-20. As soon as the proposed installation code has been adopted by the American Society of Heating and Ventilating Engineers, the National Association of Sheet Metal Contractors and the Western Warm Air Furnace and Supply Association, it will be published and recommended as a fair and reasonable guide for good installation.

In his annual message, President Irving L. Jones voiced the appreciation of the association for the work of the legislative committee, under the leadership of Edward Norris, which had charge of the preparation of the installation code, and of the sub-committee, under the leadership of Professor James D. Hoffman, which did the actual work in formulating the requirements. He also expressed his belief that the research work done at the University of Illinois by Professor A. C. Willard and his assistants, Professors S. V. Day and A. P. Kratz, will go far towards raising the place of warm-air furnace heating in the eyes of the general public.

Secretary Allen W. Williams, in his report, also paid a tribute to the work at the University of Illinois, stating that "as this work has approached and reached a practical stage, and we can say that our engineering data are soundly based on research work, the interest in it has increased wonderfully, not only on the part of our membership, but of heating engineers, their organization, architects and installers."

Professor A. C. Willard reported on the results achieved up to date in the research work at the University of Illinois, concluding with the statement that before long it will be possible for manufacturers to state specifically and accurately what any size of a warm-air furnace may be expected to do under specified conditions and what size of apparatus and air supply pipes can be safely recommended for efficient and economical heating under given conditions.

One of the papers presented at the meeting was on "Functions of Humidity," presented by Professor A. P. Kratz in which he called attention to a type of warm-air furnace recently placed on the market which has a water reservoir below the ash-pit. This furnace is said to be capable of evaporating about 26 gal. of water in 24 hours.

A paper on "What Next in Warm-Air Furnace Heating?" was presented by Professor James D. Hoffman. Among the points brought by Professor Hoffman was the fact that "most people building residences would welcome authorative information as to how best to construct them. This information may come from any worthy source, including individual, school, society or government and so long as the people believe in the honesty of the authority they will profit by it."

"The immediate consideration of the furnace men of the country," declared Professor Hoffman, "is needed not so much to regulate the furnace as it is to control the shape, size and installation of the leaders, stacks and registers. At present there is no restriction whatsoever upon any person who wishes to put in any furnace plant in any way he desires. I have no special feeling against anyone entering the furnace game either as a manufacturer or installer, but no person has a right to put out his shingle as a furnace man without being able to deliver the type and character of work that will reflect credit upon the furnace heating industry."

Philip Wyman spoke on "Place and Power of Advertising in Business," offering as a suggestion for a business slogan, "Double the industry by 1927." He presented statistics to show that a vast number of homes throughout the country not now properly heated could with advantage be equipped with furnace-heating systems.

Officers elected at the concluding session are as follows:

President, Irving L. Jones (re-elected); Vice President, E. B. Langenberg, St. Louis, Mo.; Treasurer John Kirch, Akron, O.; Secretary Allen Williams, Columbus, (reelected). Execu-

tive committee: D. Rait Richardson, New York; W. G. Wise, Akron, O.; John V. Patton, Sycamore, Ill., and John Fry, Detroit, Mich.

The full membership of the sub-committee on installation code, whose report was taken up at the concluding session and adopted, was made up of Professor James D. Hoffman, chairman; E. B. Langenberg and Jesse M. McHenry, for the American Society of Heating and Ventilating Engineers; C. L. Lyman, for the National Warm-Air Heating and Ventilating Association; George Harms, for the Western Warm-Air Furnace and Supply Association; and John H. Hussie, for the National Association of Sheet Metal Contractors.

Secretary Langenberg of the sub-committee, presented the code which was taken up section by section. Some changes were made based upon suggestions submitted by P. J. Dougherty and F. R. Still of the Advisory Committee on Warm-Air Furnace Research.

The Heating Research Situation in England.

Although some remarkable progress had been made in England in the field of heating research, one of the principal hindrances to the work has been the lack of funds. Referring to this matter, Arthur H. Barker, in his recent presidential address before the British Institution of Heating and Ventilating Engineers, told how Mr. Kinoshita, who is engaged in research work for the institution at the University College in London, in visiting Germany lately, saw a newly-erected large building in Munich, the cost of which had been borne entirely by subscriptions from individual heating contractors. He learned that these contractors had not only subscribed the capital cost, but also were keeping the Research Institution going by annual subscriptions and by sending their problems and their products to be investigated and reported on by the staff engaged. The speaker indicated that in England the profession has not as yet been seized with the necessary scientific enthusiasm to make research work the success it should be.

Considerable disappointment was also expressed over the refusal of the Government Department of Scientific and Industrial Research to approve the continuation of the investigation into the heat transmission of thin building materials, as it prevents the institution's laboratory from carrying out much useful work in that direction.

HEAT EMISSION FROM RADIATORS

The principal research now being conducted through the institution is in connection with the heat transmission from radiators, with a view of discovering, if possible, a general empirical law which will make it possible to determine the transmission constant of a radiator of any make under any given condition as regards temperature, mounting and pipe connections. As Mr. Kinoshita pointed out, if such a law were once established it would benefit not only anyone who tests or designs a new radiator, but also anyone who uses it in the calculation of heating installations.

"Up to the present," reported Mr. Kinoshita, "a very important result has been obtained which shows that the transmission of heat is proportional to the 1.3 power of the temperature difference. This means that there is a transmission constant for a particular radiator, and the old coefficient, which varies as the temperature difference can be replaced by this new single constant for all temperature differences.

"This law was confirmed in the case of two radiators of extreme types, one being a single column, 38-in. in height, and the other a window seat type, 13 in. in height. It was also proved to be true for the Classic type radiators.

"Another important result is that both for high and low radiators, top-bottom connections of the flow and return pipes, whether on the same side or on the opposite sides, gives definitely 10% to 11% higher transmission than bottom-bottom connections.

"The time available for the research has been spent chiefly on the foundation work which is necessarily, as a rule, slow, but essential in obtaining any definite result. Step by step difficulties were overcome and doubts cleared. It is now possible for us to test any radiator in a simple manner, i. e., for one method of pipe connection, say top-bottom, and for any desirable temperature difference, to give full information under varying conditions.

"This is not all that is required. The question of the temperature drop between the flow and return has not yet been fully investigated. In practice a temperature drop of 30° to 40° is generally assumed, but what will the transmission be when the flow is very fast or very slow?

"At the last meeting of the Research Committee an improved method of testing was proposed, and it was decided to adopt it without delay. Further useful results may, therefore, be expected to be made known in the near future. After this the test will become extremely simple, and the time will be devoted to obtaining the practical data."

Heating Contractors to Hold Annual Convention in Buffalo.

For the first time the heating contractors of the country will meet in annual convention in Buffalo, May 31-June 3, next. The Heating and Piping Contractors' National Association, or, as it was formerly called, the National Association of Master Steam and Hot Water Fitters, has met twice as far west as Chicago and two years ago held a successful convention in Cleveland. The selection of Buffalo brings that city prominently into the limelight as it is also to be the convention city of the American Society of Heating and Ventilating Engineers the following week.

The program for the convention of the Heating and Piping Contractors' National Association, which will be the association's 33d annual meeting, starts with the assembling of the board of directors Wednesday, May 31. The formal opening of the convention will be on Thursday, June 1, when, it is announced, the mayor of Buffalo will address the delegates. This will be followed by the address of President N. Loring Danforth, the reports of the board of directors and of standing committees. The reports of the other officers will be presented at the morning session on Friday, June 2.

Among the entertainment features are a dance at the Hotel Statler Friday evening and a trip to Niagara Falls, Sunday afternoon.

Suggestions for Garage Ventilation.

The general lack of ventilation in garages throughout the country and the consequent sickness caused to employes of such garages has prompted the Industrial Commission of Wisconsin, through R. A. Small, ventilation engineer, to take this matter up with the State legislation. The commission has perfected a method whereby every garage can supply adequate ventilation at a small cost. Mr. Small, in discussing the matter said:

"After considerable thought and observation, it seems to us that the most generally applicable method of garage ventilation consists of a forced and well distributed supply of fresh tempered air at or near the floor line, with natural outlets in roof or near the ceiling.

"Of the gases from and about an automobile engine we may say, approximately that gasoline fumes are four times as heavy as air. Carbon dioxide CO_2 fumes are 1.5 times as heavy as air; carbon monoxide CO fumes are 976 times as heavy as air.

"Modern regulations generally preclude the presence of much gasoline fumes in a garage. The other gases come hot from the engine, 250° F, and tend to rise because of this heat. When the velocity and excess of heat become dissipated, they tend to settle back to gravity strata, as in still air.

"The mechanic, the workman, the spectator, the customer, the proprietor and the engine all breathe and exhale in the zone near the floor. That is where the fresh air should be supplied or made effective.

"The rising columns of gases from lungs and cylinders should be kept moving toward a suitable discharge, so they will have no opportunity to stratify and concentrate.

"For the average public garage, where the repair area is not enclosed separate from the live storage area, we suggest that the bulk of air supply be applied at the repair area and that the outlets be arranged so that the room air traverses the live storage area toward the outlets. This will minimize the quantity of air supply necessary during the time when the cars are being taken out for the day or brought in for the night."

FIRST DRAFT OF PROPOSED STANDARD BUILDING CODE ISSUED BY DEPARTMENT OF COMMERCE

Following out its own suggestions that many of the materials used in building construction could be more fully standardized than they are at present, the Building Code Committee of the Department of Commerce has just issued its preliminary report for "Recommended Minimum Requirements for Small House Construction." This committee was organized in May, 1921, with Ira H. Woolson, consulting engineer for the National Board of Fire Underwriters, as chairman. The other members are Edwin H. Brown, Minneapolis, architect; William K. Hatt, professor of civil engineering in Purdue University; Rudolph P. Miller, superintendent of buildings, New York City; John A. Newlin, Forest Products Laboratory, Madison, Wis.; Ernest J. Russell, St. Louis, architect; and Joseph R. Worcester, Boston, consulting engineer. Frank P. Cartwright is technical secretary of the committee.

Attention is directed by the committee to the fact that this report, which covers over 100 typewritten pages, is only in tentative form. It is divided into three parts.

Part I is the introduction and covers a general description of the circumstances leading to the formation of the committee and outlining its method of procedure and scope of operation.

Part II contains "Minimum Requirements for Safe and Economical Construction of Small Buildings," in the form of an ordinance suitable for adoption by municipalities.

Part III contains the appendix, and includes material not suited to be incorporated in a building law, but which is explanatory of the various requirements made in Part II.

Defects in Existing Building Requirements.

For years it has been known that in almost every city the local building laws require more material or refinements of workmanship than are justified, considering the purpose of the buildings affected. This was disclosed during the hearings of the Senate Committee on Reconstruction and Production in 1920. It was further disclosed that building codes and builders, either through ignorance or selfish motives, frequently fail to recognize modern methods of construction intended to lessen cost.

"The building codes of the country," states the Senate Committee's report, "have not been developed upon scientific data, but rather on compromises; they are not uniform in principle and, in many instances, involve an additional cost of construction without assuring more useful or more durable buildings."

It was found that out of a total of 1478 cities in the United States in 1920 having a population of 5,000 or more, as many as 328, or 22%, have no building code or inspector.

Secretary Hoover is directly responsible for the appointment of the present committee and has made it a part of the newly-created Division of Buildings and Housing which has under way a broad program of investigation into the causes of building industry sluggishness and possible remedies therefor. The committee is established in the Department of Commerce Building in Washington.

General Purposes of Committee.

In outlining the work to be taken up by the committee, the main points to be covered are given as follows:

1. To study existing building codes and determine the nature of their disagreement and the extent to which their requirements are oppressive to the building industry.

2. To gather information concerning minimum requirements considered essential by architects and engineers for safe and proper construction of buildings of different types and varying occupancy, in an effort to secure safe, economical construction, and eliminate waste in building.

3. To prepare and publish recommended building regulations based upon the consensus of reliable information obtained, such recommendations to represent minimum safe practice in all matters pertaining to engineering design and general building methods.

4. To investigate the merits of new building materials and methods of construction which promise economy.

5. The committee may use its influence to further any measures promising improvement in present methods of building regulation or which encourage building industry.

6. It is not the purpose of the committee, at least for the present, to draft a complete building code. It believes the main objects desired can be most quickly and easily secured by recommending standards of practice in those portions of the building codes subject to the greatest general criticism.

In taking up the work, precedence was given to dwelling construction on account of the great scarcity of dwellings throughout the country. The committee then states how it proceeded to get the information on which the present preliminary report is based. Among the many suggestions received meriting special attention, one frequently repeated and strongly emphasized, was that plumbing requirements should be revised and standardized. Accepting this suggestion the committee made analyses of 80 selected plumbing ordinances to ascertain average and extreme types of practice. It promptly developed, states the report, that there was unanimity of thought that economies could be effected, but no agreement as to plans for accomplishing same. Strong differences of opinion existed as to the merits of various plumbing devices and special methods of installation. As a result of this investigation, the Bureau of Standards offered to conduct an investigation if provided with a schedule of tests. A sub-committee on plumbing, therefore, was formed to supervise the investigation and to draft recommendations for plumbing requirements after completion of the tests. This committee is headed by Professor George C. Whipple, professor of sanitary engineering in Harvard University. Experimental work has already begun at the Bureau of Standards.

Publication of Parts II and III of the report is being withheld as, so far, they are only in tentative form and will no doubt undergo numerous revisions before being finally published as the committee's recommendations. It may be stated, however, that the tentative code for chimneys is based largely upon the requirements recently promulgated by the National Board of Fire Underwriters.

The report as published is submitted in its present form for criticism and is being sent to all technical and industrial organizations interested in the subject of building construction, as well as to numerous individual architects and engineers.

American Building Exposition in Cleveland.

Among the exhibitors at the American Building Exposition in Cleveland, April 23-May 2, were the Heating and Piping Contractors' Cleveland Association and the following manufacturers of heating and ventilating apparatus: Mouat-Squires Co., Cleveland; American Radiator Company, Chicago; Utica Heater Co., Utica, N. Y.; Stark Sheet Metal Works Co., Canton, Ill.; Bishop & Babcock Co., Cleveland; Johnson Service Co., Milwaukee; H. B .Smith Co., Westfield, Mass.; Everhot Heater Co., Cleveland; Weil-McLain Co., Cleveland; Minneapolis Heat Regulator Co., Minneapolis; Garford Founddies Co., Cleveland (now manufacturer of the Bernard boiler); Si-Fo Ventilator Co., Cleveland; and the Hughes-Limbach Co., Cleveland (oil burners).

"Cost Plus" Rates in Central Station Heating.

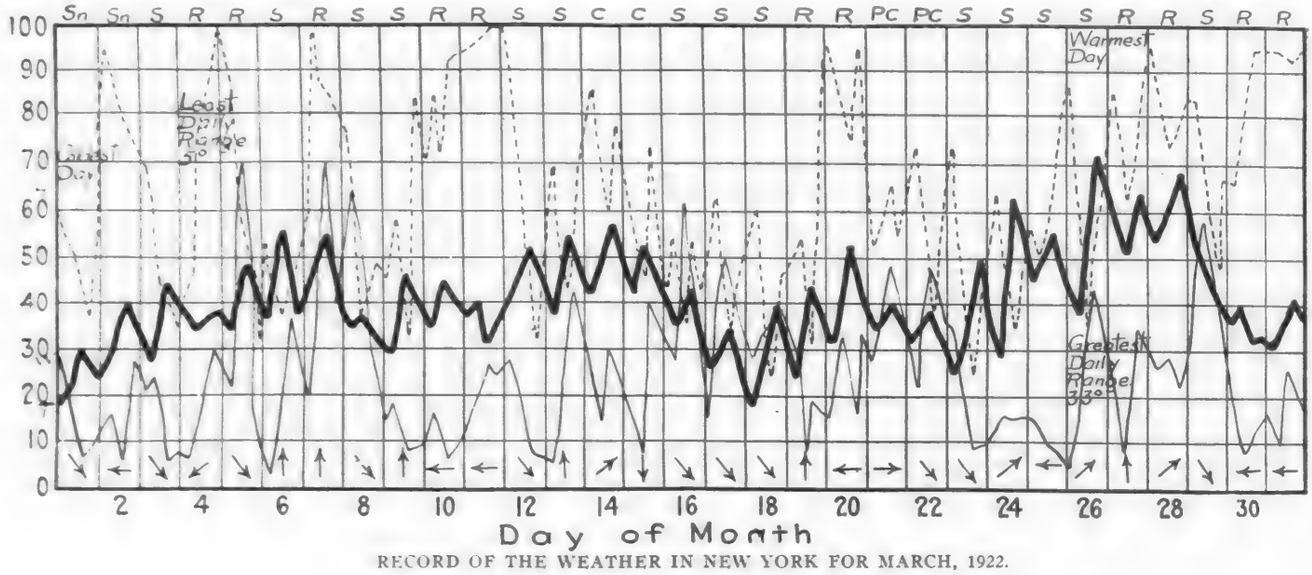
"Cost plus" as applied to the rates charged for central station heating service has come into vogue recently and has aroused curiosity in some quarters as to its precise meaning. "Cost plus" rates are simply those based on the actual cost of operation, plus an agreed percentage profit. As in building construction, its great drawback lies in the fact that some individuals and corporations cannot resist the temptation to profiteer where there is no check to protect their customers.

For his reason such agreements may be of little value unless adequate legal, accounting and engineering skill is employed by those served.

City fathers would be wise if they consulted with reliable utility rate experts who can furnish the range of technical skill named, instead of depending upon local legal talent unversed in corporation law.

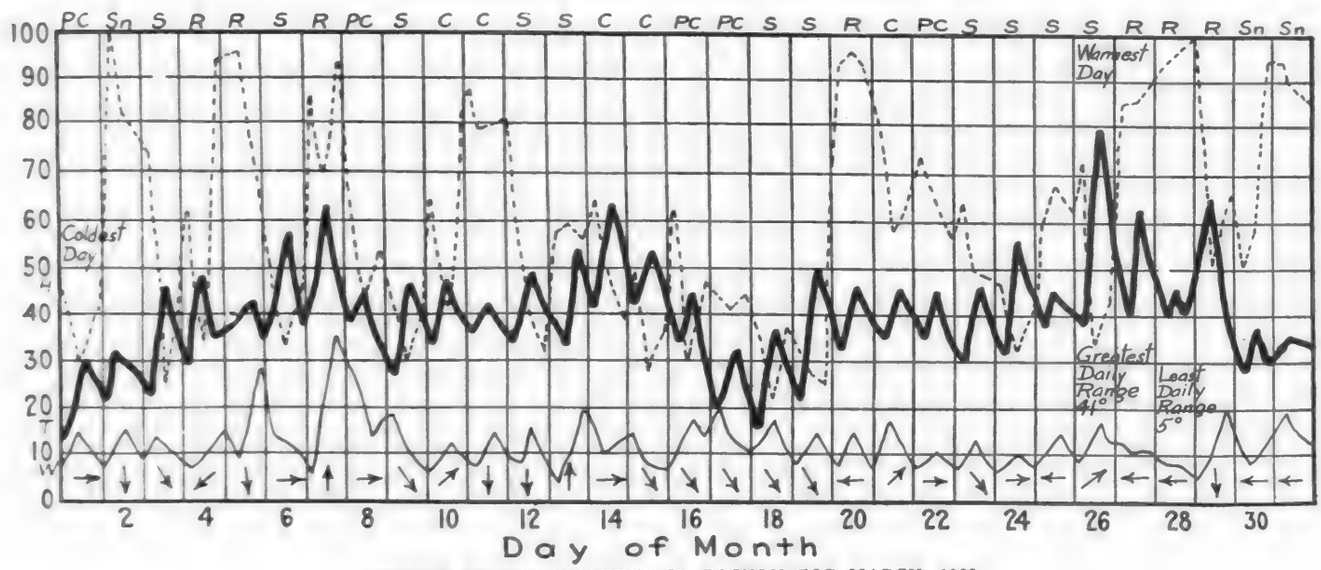
THE WEATHER FOR MARCH, 1922

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	72	70	75	66	76
Date of highest temperature	26	26	25	25	24
Lowest temperature, degrees F.	17	14	18	23	21
Date of lowest temperature	1	1	1	1	1
Greatest daily range, degrees F.	33	41	34	28	29
Date of greatest daily range	26	26	6	25	25
Least daily range, degrees F.	5	5	5	3	5
Date of least daily range	4	11, 28	21	26	20
Mean temp. for month, degrees F.	41.3	39.6	43	39.4	46.2
Normal mean temp. for month, degrees F	37.5	35.	39.6	36.3	43.8
Total rainfall, in.	4.35	4.30	5.84	5.58	4.84
Total snowfall, in.	3.5	10.1	11.0	2.8	5.2
Normal precipitation, this month, in.	4.10	4.08	3.01	2.55	3.43
Total wind movement, miles	13,949	6,464	8,987	10,939	11,661
Prevailing direction of wind	N. W.	N.W.	N.W.	N.E	S.
Number of clear days	6	9	8	8	8
Number of partly cloudy days	11	7	2	6	6
Number of cloudy days	14	15	21	17	17
Number of days on which rain fell	9	10	10	11	12
Number of days on which snow fell	4	3	4	3	1
Snow on ground at end of month, in.	None	2.2	None	1.1	None

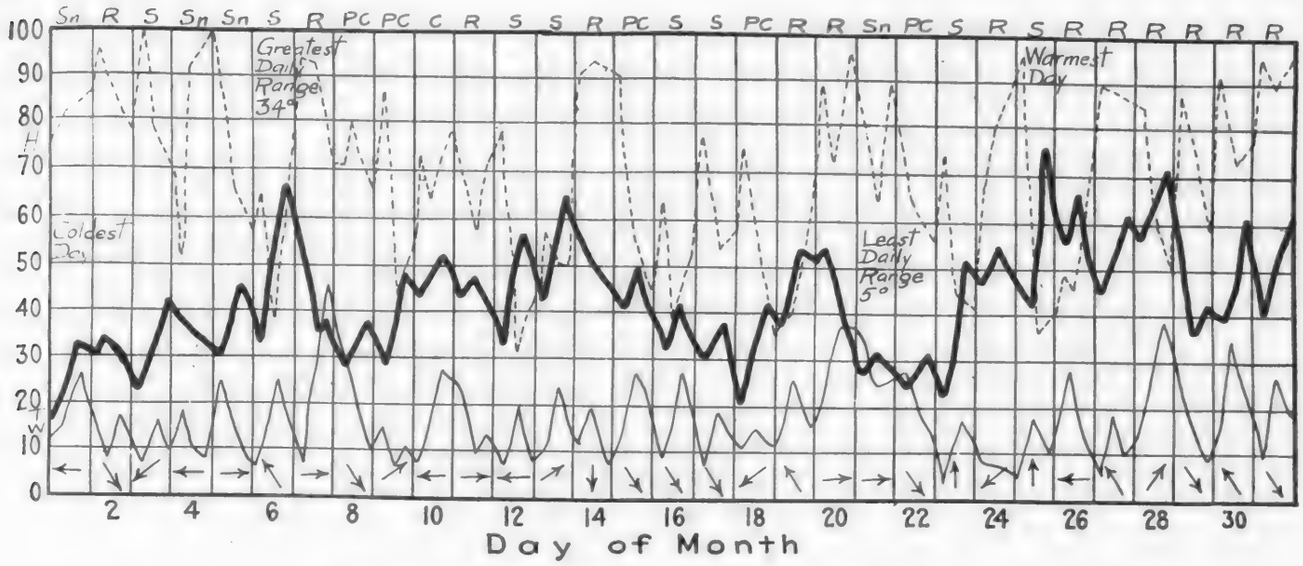

Sn Sn S R R S R S S R R S S C C S S S R R Pc Pc S S S S R R S R R
Warmest Day
Least Daily Range 5°
Coldest Day
Greatest Daily Range 33°
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1922.

(Hourly Observations of the Relative Humidity Plotted on this Chart.)


Pc Sn S R R S R Pc S C C S S C C Pc Pc S S R C Pc S S S S R R R Sn Sn
Warmest Day
Coldest Day
Greatest Daily Range 41°
Least Daily Range 5°
100 90 80 70 60 50 40 30 20 10 0
T W
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1922.


Sn R S Sn Sn S R PC PC C R S S R PC S S PC R R Sn PC S R S R R R R R
Greatest Daily Range 34°
Warmest Day
Coldest Day
Least Daily Range 5°
H
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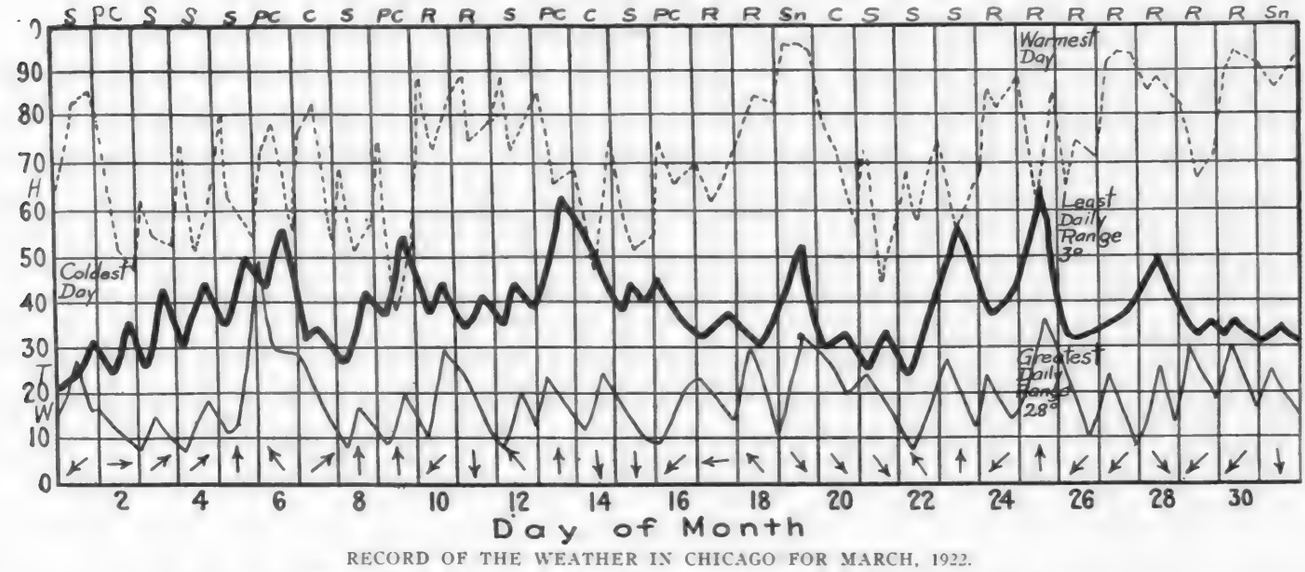
W
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1922.


S PC S S S PC C S PC R R S PC C S PC R R Sn C S S S R R R R R R Sn
Warmest Day
Least Daily Range 3°
Coldest Day
Greatest Daily Range 28°
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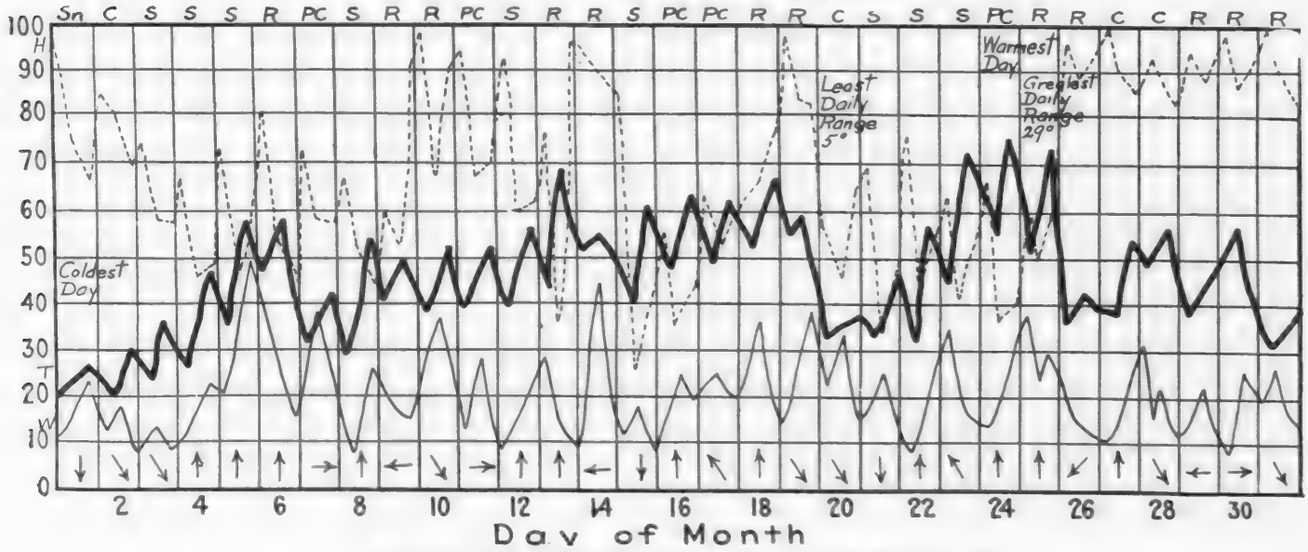
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1922.


Sn C S S S R PC S R R PC S R R S PC PC R R C S S S PC R R C C R R R
Warmest Day
Least Daily Range 5°
Greatest Daily Range 29°
Coldest Day
H
T
W
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1922.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken line indicates humidity in percentage from readings taken at 8 a. m., 12 m., and 8 p. m.
S—Clear, P C—partly clouly, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

TYPES OF WATER SERVICE HEATERS

VI—By T. W. Reynolds

Water service heaters, because of their wide adaptability to the furnishing of large or small quantities of hot water supply, are used extensively in hotels, hospitals, sanitariums, industrial plants, apartment houses, and many other classes of buildings.

To the list of such heaters recently described in these columns, may be added still another, as reported by the American District Steam Co., manufacturers of the Adsco water heaters, shown herewith. These heaters, though well adapted to the usual purposes of hot water supply, are especially suitable for use in heating, by water, any building in which the steam supply is from a central station heating system, individual boiler, or other source. In this way, the heaters become transformers, taking the heat from the steam, and passing it on to the hot water used as a heating medium.

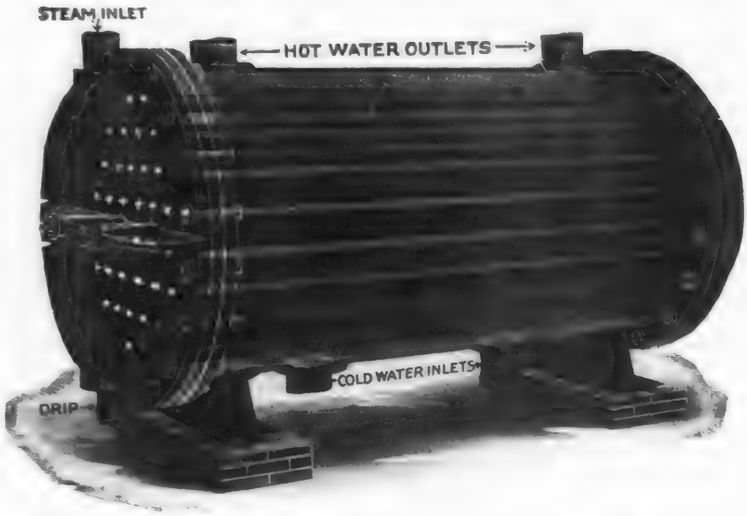


FIG. 2.—PHANTOM VIEW OF ADSCO WATER HEATER.

COMBINATION STEAM AND HOT WATER SYSTEMS FOR HEATING BUILDINGS.

Such a method of heating has been found very satisfactory, in particular for buildings in which the water type of radiation already exists, as the heater may be readily connected, and at a minimum expense.

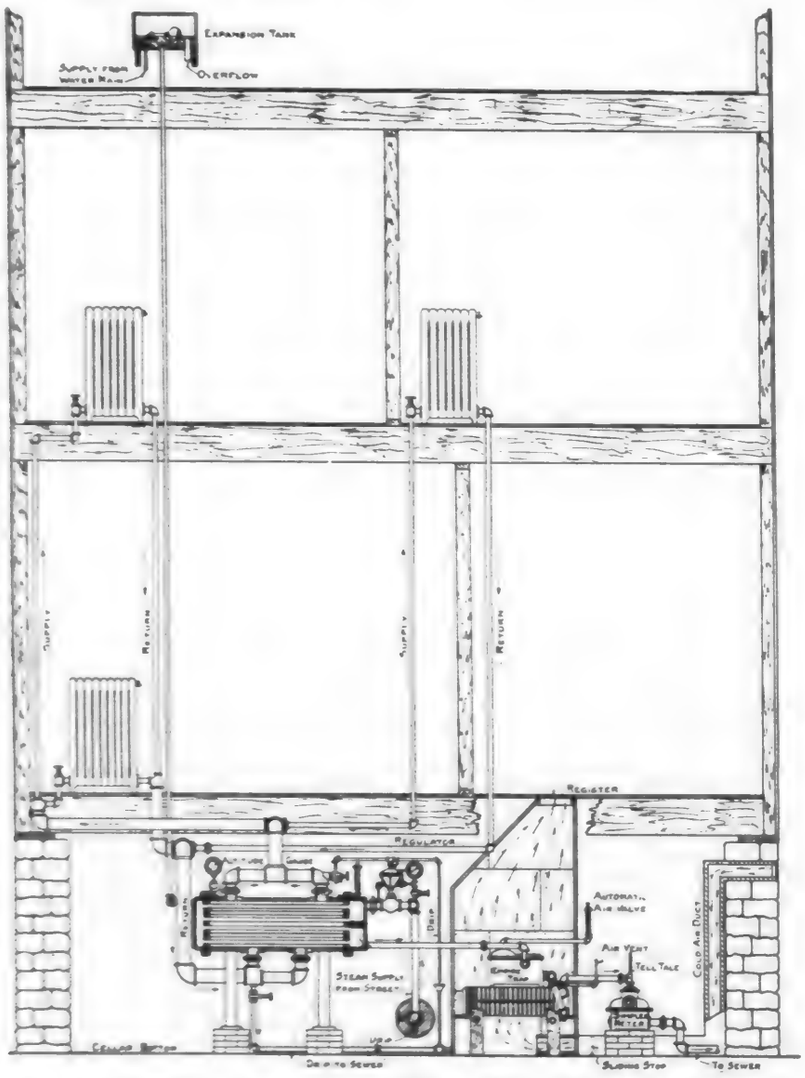


FIG. 1.—TYPICAL COMBINATION STEAM AND HOT WATER SYSTEM FOR HEATING BUILDINGS.

A typical combination heating system of this nature, as shown in Fig. 1, possesses many features of interest. Note that the steam supply enters from the street, is valved and dripped at the rise, then connected to the heater through an automatic temperature regulator, thus making a simple and efficient installation.

Steam entering this heater passes through the tubes in the upper half, and back through the tubes in the lower half; thus eliminating the formation of an air pocket which would decrease the heating efficiency. Condensation flows by gravity through a steam trap, a radiator of the indirect type (upon which the steam trap is mounted), and a meter in which the condensation is measured, after which it enters the sewer.

RECLAIMING THE HEAT FROM WASTE CONDENSATION.

This location of steam trap and radiator (within a chamber to which a cold air duct is connected) is the second feature of major interest; possessing as it does, not only a measure of conservation, but also, the prevention of high-temperature water from entering the sewer, the latter being objectionable and prohibited by most city ordinances.

Air entering the chamber passes over the hot surfaces of the trap and radiator, reclaiming heat (otherwise lost) from the waste condensation flowing through them. This air being heated, rises and leaves through a register in the floor of the room above, providing ventilation as well as warmth to the occupants of this room.

For obvious reasons, the air vent of the radiator and the automatic air valve of the steam trap are piped so as to discharge outside of the chamber. Other details are a sliding stop located in the

cold air duct, a tell tale on the meter, and a full size outlet between the meter and free opening to the sewer.

DETAILS OF THE SYSTEM.

A water service heater, installed for the purpose shown, requires an expansion tank located at some high point, preferably in the attic. To this tank, the usual overflow and water supply connections are made, using a ball cock for automatic filling. An altitude gauge connected to the top of the heater indicates the height of water in the system, and a steam gauge, installed where shown, indicates the pressure of steam supply from the street.

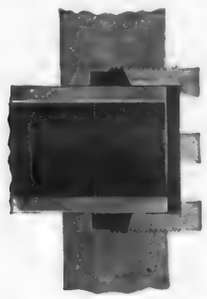


FIG. 4.—CROSS SECTION OF HEATER HEAD SHOWING PACKING GLAND AND ALLOWANCE MADE FOR EXPANSION OF TUBES.

Connected to the lowest point of the system, at the return below the heater, is the draw-off. This is piped to the sewer, as is also the open discharge from the temperature regulator.

Heaters of this type are also used for heating swimming pools, an installation of this kind being shown in Fig. 3. The tank is filled with fresh water through the heater, as shown by plain arrows, natural circulation takes place as shown by feathered arrows, and the system is backflushed (cleansed) to the sewer, as shown by double headed arrows.

Fig. 2 illustrates in phantom view the construction of the Adsco heater, which may be furnished, either horizontal as illustrated, or vertical, as conditions require.

The shell is made of cast-iron which insures the life of the heater and eliminates the possibility of pitting, a complaint so common where steel is used. By removing the covers at either end, all inside parts become easily accessible for inspection when necessary, the tube plates being fastened to the body of the heater independently of the covers. Heaters are provided with cast-iron supports which may rest on masonry or other foundations.

Only brass tubes are used and these are installed so as to pass through head plates at each end of the heater, as shown in the sectional view of the tube and packing gland (Fig. 4). This gland is constructed especially for the purpose of preventing the possibility of leaks, or damage, due to the difference in expansion between brass tubes and cast-iron head plates. Such a method of assembling the tubes in the heater does away with threads or expanded connections, and obviates the liability of tubes pulling out of the stuffing box from the opposite end.

The accompanying tables give general dimensions and heating capacities of the heaters, and shows by the large number of sizes listed, the adaptability of these heaters to all requirements. In selecting from this table the size of heater required, allowance should be made not only for the square feet of direct radiation connected to the system, but also for the heat given off from uncovered piping.

SIZES AND CAPACITIES OF ADSCO WATER HEATERS

Size	Sq. Ft. Heating Surface (Brass Tubes)	Approx. Gals. Heated Per Hour 50° to 150°
12 x 11½	5	285
12 x 17	7	400
12 x 23½	9	515
12 x 2-4	11	625
12 x 2-9½	13	740
12 x 3-3½	15	855
12 x 3-9	17	970
12 x 4-2½	19	1085
16 x 2-4½	22	1255
16 x 2-8½	25	1425
16 x 3-1	28	1595
16 x 3-6½	32	1825
16 x 4-0	36	2050
16 x 5-1½	46	2620
24 x 3-2½	59	3365
24 x 3-11½	72	4105
24 x 4-10½	88	5015
24 x 5-10½	105	5985
24 x 7-0½	125	7125
42 x 3-4	154	8780
42 x 4-2½	194	11060
42 x 5-5½	249	14195
42 x 6-0	275	15675
42 x 6-11	315	17955
42 x 7-11½	362	20035
42 x 8-9½	399	22745
42 x 10-1½	458	26105
42 x 10-8½	483	27530

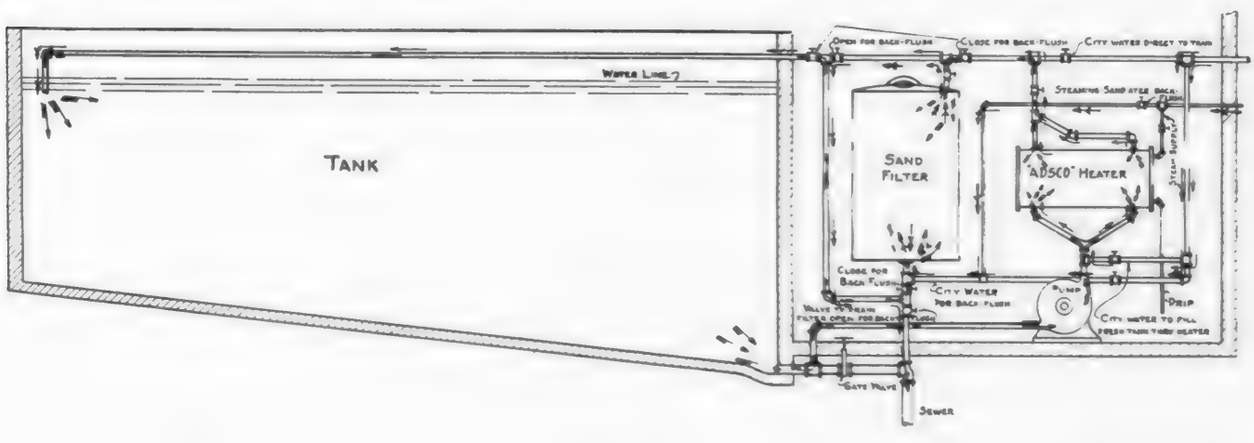
"Give Him Fresh Air."

If a man faints in a crowded, poorly-ventilated room, the cry is "Stand back, give him fresh air." Some helpful individual usually loosens the garments at his throat, fans him, and perhaps sprinkles water on his face.

The result is the man soon regains consciousness, but the man did not faint for lack of air, and he does not recover because more air is supplied; it is not a question of air at all; it is entirely a matter of heat.

In the poorly-ventilated room the temperature or humidity, or possibly both, becomes so high that the human body does not give off the excess heat generated, and the man faints from what the physician calls "heat prostration," and when we loosen his clothing, fan him, and sprinkle water on his face, we aid Nature, not in giving him more air, but in reducing his body temperature, thus hastening his return to consciousness. — DAVID M. HAINES *before the National Association of Sheet Metal Contractors.*

The entire coal consumption for France is not over 60,000,000 tons per annum, of which a third came from abroad before the war and somewhat more to-day.



FILLING TANK FRESH WATER THRU HEATER
NATURAL CIRCULATION.
BACK FLUSH

FIG. 3.—ARRANGEMENT OF ADSCO WATER HEATER AND PIPING FOR HEATING SWIMMING POOL.

THE COST OF BUILDING

Striking evidence that at last financial institutions are willing to accept the present costs as sufficiently stable to recommend construction is furnished in a bulletin recently issued by the Chemical National Bank, of New York, which analyzes in considerable detail the cost of building at the present time with that existing during the pre-war period. The data given are on residence construction, but would be applicable, of course, to other types of buildings of similar construction. The failure of the banks to take such a stand previously has in no small measure held back the actual construction of buildings of all classes, so that the change-of-attitude would seem to augur well for the building industry in 1922

The detailed figures present a comparison of the cost of building a home in 1914 with the cost of the same building in 1920, at the peak of the high price wave, and in March, 1922. The figures are for three different types of residences, showing, in each case, the changes in the various elements in labor and material costs.

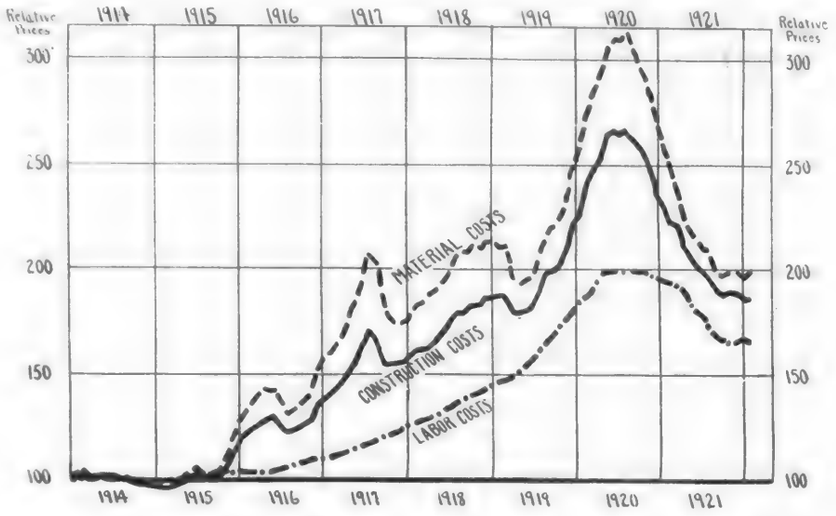
A home of type A cost in 1914, $5,529. In 1920 the same house cost $12,815, an increase of 131% in relation to the 1914 figure. In March, 1922, such a house would cost $9,502, 71% more than the 1914 cost, and 26% below the maximum cost in 1920.

The rise in prices and wage increases between 1914 and 1920 more than doubled building costs between those two dates. The subsequent decline, while not sufficient to restore costs to the old level, has brought about a very material decrease in the fall in two years amounting to 25% of costs at the peak.

The prospective builder is, of course, interested in knowing whether he may look for further declines, for which he should wait. It would be beyond the scope of this article to attempt to forecast the course of building costs in the future. General wholesale prices, as measured by the index number of the U. S. Bureau of Labor Statistics, seem to be stabilized at a level about 50% above that of the pre-war period. Building costs are above this level, but many of the elements which bulk large in building costs, such as freight rates and wage rates, are less susceptible to downward revison than are commodity prices in general. The general housing shortage, and the increasing volume of building at present price levels are factors which serve to strengthen building material prices. While it is entirely possible, therefore, that building costs may decline still further, it is not probable that drastic declines will occur.

The trend of general commodity prices was upward between 1896 and 1920, and building costs followed the general course. Until 1915 the increase was gradual, with short downward swings during the years 1904, 1908, 1911 and 1914. The year 1915 witnessed the beginning of a more rapid rise, and the rate was still further accelerated in 1919 and early 1920. The latter year was the turning point, and the downward rush of prices equaled the rise of the preceding year, continuing for twelve months before any definite slackening of the fall occurred.

The accompanying chart portrays the course of general construction costs in all classes of buildings, and one of the two chief items entering into those costs, between 1914 and 1922. The three curves on the chart are based upon weighted index numbers of building material costs, building labor costs, and a combination of the two. The average costs during 1914 are taken to equal 100 in each case.



COURSE OF GENERAL CONSTRUCTION COSTS, 1914 TO 1922.

It is apparent that the increase in construction costs between 1915 and 1917 was almost entirely due to the increase in material prices. These had doubled by the summer of 1917, while building labor costs had increased 18%. "The increase in labor costs continued, constituting a more im-

TYPE A—TWO-STORY FRAME HOUSE

7 Rooms—Size 30 ft. x 34 ft.

Contents 29,100 cu. ft.—Floor Area 2,640 sq. ft.

	1914	(Peak) 1920	March 1922
Excavation	$240.00	$420.00	$420.00
Foundations and Cement	470.00	1,459.00	1,167.00
Masonry	250.00	667.00	543.00
Plastering	359.00	962.00	809.00
Carpentry and Glass	2,520.00	5,629.00	3,845.00
Painting	320.00	608.00	560.00
Plumbing and Gas	350.00	686.00	517.00
Heating	400.00	1,029.00	712.00
Metal Work	180.00	455.00	291.00
Tile Work	40.00	87.00	54.00
Mantels	80.00	173.00	109.00
Electric	250.00	500.00	377.00
Hardware	70.00	140.00	98.00
Total Cost	5,529.00	$12,815.00	$9,502.00
Cost per cu. ft.	$0.19	$0.44	$0.325
Cost per sq. ft.	2.09	4.85	3.60
Percent of Change	100%	231%	171%

The cost of a home of type B in 1914 was $4,176. To build such a house in 1920 cost $9,767, 133% above 1914 costs. The present cost of this home is $7,374, which is 76% above 1914 prices and 24% below the maximum cost.

TYPE B—TWO-STORY COLONIAL HOUSE.

8 Rooms (Incl. Two Attic Rooms)—Size 23 ft. x 41 ft.

Contents 25,315 cu. ft.—Floor Area 2,530 sq. ft.

	1914	Peak 1920	March 1922
Total Cost	$4,176.00	$9,767.00	$7,374.00
Cost per cu. ft.	$0.165	$0.385	$0.29
Cost per sq. ft.	1.65	3.86	2.91
Percent of Change	100%	233%	176%

The 1914 cost of a type C home was $4,701, which by 1920 had risen to $10,913, a figure 132% above the earlier cost. The cost of erecting this house in March, 1922 ,is $8,112, 72% above the 1914 cost and 26% below the peak cost.

TYPE C—TWO-STORY SHINGLE HOUSE

8 Rooms (Small)—Size 26 ft. x 35 ft.

Contents 24,360 cu. ft.—Floor Area 2,385 sq. ft.

	1914	(Peak) 1920	March 1922
Total Cost	$4,701.00	$10,913.00	$8,112.00
Cost per cu. ft.	$0.193	$0.448	$0.333
Cost per sq. ft.	2.00	4.64	3.68
Percent of Change	100%	232%	172%

portant factor in later additions to construction costs. In 1920 labor costs had reached a maximum, 100% above the 1914 average. Material costs, at the same date, were 212% above the 1914 average. At this peak which was reached in August, 1920, construction costs were 167% above pre-war costs. The precipitate decline in material costs brought general construction costs down in the latter part of 1920, though labor costs maintained their level during that year. The year 1921 brought recissions in both groups, and by February, 1922, material costs stood 98% above their pre-war average, with labor costs 65% above. The weighted average of the two, which is taken to represent the general cost of construction, was 85% above the 1914 figure in February, 1922.

It is worthy of note that there have been no marked changes in material costs or in general construction costs since September, 1921, though there have been slight recissions in labor costs. Certain building materials have actually increased in price during the last several months. This has been due to renewed bidd ng for materials with the increased building activity of recent months.

NATIONAL TRADE EXTENSION BUREAU

"Heat by Radiator" Advertisements.

Effective publicity matter for the "Heat by Radiator" campaign is shown in the accompanying typical layouts prepared by the National Trade Extension Bureau, Evansville, Ind. Although this campaign was scheduled for the week of March 20-25, there is an appeal here which the heating industry can use as a permanent feature of its activities.

Amount of Heat Loss in Condensate.

A correspondent in the April issue called attention to a statement made by the writer of "The Importance of Proper Condensation Control" that "for every degree Fahrenheit above the minimum (temperature) requirement there is approximately 100 heat units loss per pound of condensate." As he pointed out, the figure should have been 10, instead of 100. The author of the article in question, in commenting on the matter writes:

"The writer of the comments on the article which appeared in March on condensation is right. I see that I have not checked myself properly and, as a result, have used 100 when 10 was intended. I regret this very much as I am not desirous of making such errors. Will you kindly note the fact that this mistake was made? But do not blame it on the humble and much-abused slide rule.

"There will always be a difference of opinion with engineers as to the value of returning condensate to boilers at high temperatures. The writer of the comments, I think, has not considered the loss due to radiation, etc., which is one of the main reasons why it does not pay to put to work all of the heat possible in every pound of steam, regardless of return temperatures."

TYPICAL, "HEAT BY RADIATOR" ADVERTISEMENTS SENT OUT BY NATIONAL TRADE EXTENSION BUREAU.

New Hospital for Those Injured in the Industries.

As a direct result of the world-wide experiments in rehabilitation of men injured in war, America has now a hospital dedicated solely to the care of industrial diseases and accidents and the restoration of industrial casualties to active useful life again. The Reconstruction Hospital, with the breaking of ground Sunday, April 2, for its eleven-story addition at 100th Street and Central Park West, New York City, now enters upon a national career, prepared to offer a unique service to industry. The beginning of the new building marks the end of the first year at the present location.

It is a new idea to have a hospital where men suffering from any of the many casualties of industry may receive the benefits of an intensive study of their cases by surgeons specializing in all the newest forms of therapy, combined with the complete after-care of the patient until he is fit to earn a livelihood. Yet in the brief life of the present hospital, men have been sent from all over the country to take advantage of its unusual treatment, and many suffering from seemingly incurable physical ailments and distortions have been returned to useful industrial life again.

The plans provide for space for 175 beds in small wards and semi-private rooms where women and children may be treated, as well as men. The total cost of the new annex will be $1,500,000. It is hoped to complete the first two stories at once to relieve the pressure on the present hospital in which an average of 175 cases receive treatment daily, half of that number being sent by the Government.

An interesting feature of the groundbreaking ceremony was the participation of two men who were patients in the hospital a year ago. At that time one of them was totally paralyzed below the waist as the result of a fall and the other was unable to use his arms. Both have since been restored completely and were chosen to represent the hundreds of other men who, crippled through accidents in industries, have been restored.

It will be of interest to our readers to know that Dr. W. Gilman Thompson, who figured prominently during past years in discussions of ventilating practices, is president of the Reconstruction Hospital. In writing of the advantages gained in an economic way through the

restoration of injured workmen, he states: "One outcome of the Great War was an intelligent study of means, both mechanical and therapeutic, to bring maimed men back to physical health and usefulness again. Canadian, British and French surgeons co-operated with the Americans in studying all phases of reconstruction work and developing new treatments to help. Their success was beyond imagination, as we know."

New Apparatus and Appliances

Condo-Vac Return-Line Vacuum Pump.

A new addition to the line of return-line vacuum pumps is announced by the Chicago Pump Co., Chicago, Ill., under the name of the Condo-Vac return-line pump. It is designed to overcome the disadvantages of a divided casing where one-half contains the water impeller and the other half the air rotor. In that form of construction, it is stated, there was the difficulty that the centrifugal pump has to handle hot water and, at the same time, contend with air. With both air and water

CONDO VAC RETURN LINE VACUUM PUMP.

pumps in the same casing and under a constant vacuum, it is stated, there will always be a tendency for air to be drawn through the bearing into the water pump. It was also desired to eliminate the necessity of running both pumps when only one is needed.

In the new design each pump is individually controlled by an individual motor. Therefore, each pump operates only when necessary. Both pumps and motors are mounted on one base upon which is also mounted a receiver, all being connected up, ready for use. The water pump is connected to the bottom of the receiver, pumping the condensation directly to the boiler. The air pump is connected to the bottom of the receiver, exhausting the air to the atmosphere.

Special emphasis is laid on the fact that the pumps, motors and receiver are mounted on one base, no footing being necessary on the job because it is all done at the factory.

Automatic Low Water Shut-Off Valve for Gas-Fired Steam Boilers.

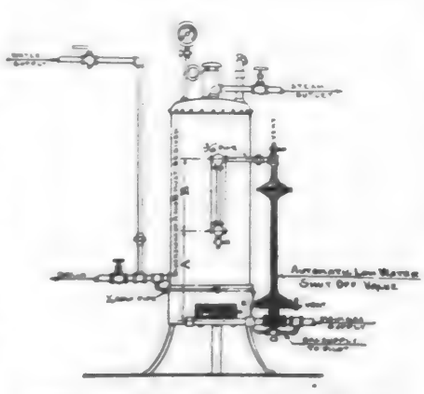
An automatic low water shut-off valve, made especially for application to gas-fired steam boilers, is announced by the Atlas Valve Co., Newark, N. J. Referring to the accompanying illustration, the shaded portion shown at the right of the boiler proper constitutes the device. It is virtually a "water column" made of pipe fittings and ordinary pipe, with two enlarged portions. A vent is located at the top as shown. Going downward first comes a tee, then a nipple, then an enlarged portion or chamber and then a pipe connecting the latter to another enlarged chamber which contains a diaphragm. This diaphragm controls the gas valve in the main gas supply pipe.

When filling the boiler the first time, the two vent cocks shown should be opened and the boiler filled until the water flows freely from both of the vents. Then close the vents and drain the water from the boiler down to the proper operating level.

It will be seen that the water cannot drain out of the stand pipe and it will remain full. A constant pressure due to this constant head of water therefore exists at all times on top of the diaphragm. The upper enlarged portion of the "stand pipe" is providing for the purpose of furnishing an ample storage supply of water so that this pressure will remain constant as otherwise it might vary due to any possible fluctuations in the diaphragm in the enlarged portion below.

As will be noted, another connection is made between the boiler and the "stand pipe" into the enlarged chamber beneath the diaphragm through a ¼ in. galvanized pipe. This, then, gives two water pressures acting on the diaphragm—the constant one from above and the variable one from below.

As the water level in the boiler lowers, the pressure beneath the diaphragm grows less and less and the difference in the pressure acting on the diaphragm becomes greater until at a predetermined point the gas supply is shut off. The point of shut off is usually at the lower limit of the gauge glass. Therefore, when the water level reaches the bottom of the gauge glass, the automatic valve will shut off the gas and will keep it shut off until the boiler is refilled to the proper operating level. In refilling it is not necessary, of course, to reopen the vents because the "stand pipe" is still full of water.



NEW AUTOMATIC GAS SHUT-OFF VALVE.

The manufacturers state that when ordering this device or when asking for quotations, the dimensions "A" and "B" must be given.

Trade Literature.

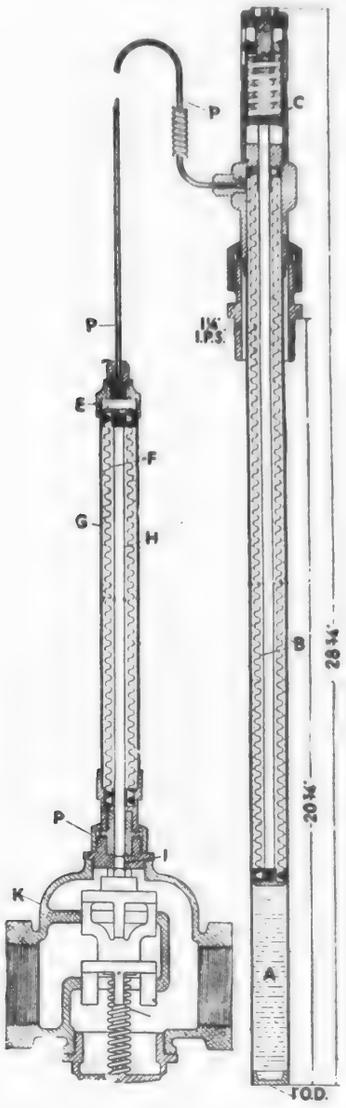
REDUCING VALVES, WITH TABLES AND RULES FOR DETERMINING THE CAPACITY OF REDUCING VALVES AND PIPE CONNECTIONS, is the title of a notable catalogue, constituting in reality an engineering handbook, just issued by the Atlas Valve Co., Newark, N. J. In discussing the subject the statement is made that most reducing valves, as used to-day, are needlessly large—often twice or three times too large. Consequently they are needlessly expensive. Because a pipe is 3 in. in diameter, it is common practice to order a 3 in. reducing valve, whereas a 1½ in. or even a 1 in. reducing valve might do as well or better. Since a reducing valve is virtually an "obstruction" in the steam pipe anyway, runs the company's argument, why make the valve body large and costly? Why not make it just large enough to accommodate the valve and seat and permit sufficient valve lift? The flow of steam through pipes is handled in the catalogue in a decidedly simple and understandable manner. Charts and formulas are entirely eliminated. Handy tables make it possible for the user to determine at a glance just what a given pipe size will do. Or, the tables will enable the user to select the proper size of pipe needed for a given weight of steam per minute. Reducing valve sizes are, of course, completely covered. Other important features are superheated steam; extra heavy pipe; pipe fittings; leaders to heating systems; pipe friction allowances; steam velocities; etc.

To further assist the user in making everything perfectly clear and plain the handbook abounds in problems all worked out. Copies of the handbook, it is stated, may be obtained on request by any of our readers. Size 4 by 5 in. Pp. 26.

ELECTRIC HEAT AND CONTROL, featuring such device as electro-thermostats, heating lamps, electric heating units, and pencil-type thermostats, is the title of a four-page circular received from the Atlas Laboratory Equipment Bureau, 731 North Wells St., Chicago, Ill. The devices are especially adaptable for experimental work.

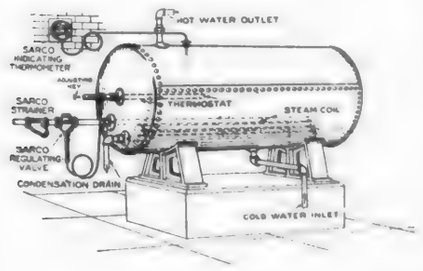
SARCO TEMPERATURE CONTROL is discussed in a new bulletin received from the Sarco Co., Woolworth Building, New York. The various types of Sarco

regulators and their application are illustrated. In each type the actuating member is the well-known spirally-cor-



DESIGN OF SARCO TEMPERATURE REGULATOR.

rugated expansion member. These regulators are made to control temperatures from 30° to 300° F. and may be had in a variety of styles to suit specific installations. They are also furnished, it is stated, with reverse action valves to close



TYPICAL APPLICATION OF SARCO TEMPERATURE CONTROL DEVICES.

on rising temperatures. Size 6 by 9 in. Pp. 8.

UEHLING CO_2 RECORDING EQUIPMENT is described in a bulletin received from the Uehling Instrument Co., Paterson, N. J. The bulletin emphasizes the advantages of clean gas-sampling lines as provided by its new Pyro-porous gas filters which, it is claimed, will remain perfectly clean for long periods of time. It is also pointed out that with clean gas lines small pipe sizes may be utilized, allowing the gas to travel to the CO_2 gas meter with comparatively high speed. In this way the CO_2 meter may be placed at a considerable distance from the source of gas. Equipment for simultaneous readings on from one to six furnaces are shown and described. Size 6 by 9 in. Pp. 12. Punched for binding.

PIERCE DOWN-DRAFT, A HEATING BOILER OF QUALITY, is the way the Pierce, Butler & Pierce Corporation, New York, refers to this heater in an attractive catalogue. The boiler is illustrated and described in detail and attention is called to the proper selection of fuels. The feeding of the coal to the fire is likened to the action of the mechanical stoker in use in large power plants, without the disadvantage of complicated mechanism of any sort. It is also stated that, due to the fact that all of the gases formed have to pass through the incandescent fuel bed, they are consumed and smokeless operation assured. Size 4½ by 6¼ in. Pp. 33.

GRISCOM-RUSSELL EVAPORATOR SYSTEMS for the economical production of distilled boiler feed-water are presented in Bulletin No. 360, published by the Griscom-Russell Co., 90 West Street, New York. This booklet, which is just off the press, is so written that the application of Reilly evaporators, self-scaling, to the power plant, for the elimination of scale, blowdown, printing, etc., can be readily understood by the non-technical executive, as well as by the engineer. Size 6 by 9 in. Pp. 6, punched for binding.

SPRAGUE NARROW-UNIT PANELBOARDS (safety type) are featured in a bulletin issued by the Sprague Electric Works, New York. This style panel has been designed to meet the demand for a high-grade safety-type panel at a moderate price. The panel is only 10 in. wide outside the barriers and is of sectional construction, double branch. It is built in units of four and six circuits each and the base is modeled of insulating compound which, it is stated, is practically unbreakable. A table of standard dimensions, capacities, weights and arrangements is appended. Size 8 by 10½ in. Pp. 4.

TWELVE GOOD REASONS why home and building owners should insist on the Dole Shure-Vent air valve are given in a new circular issued by the Dole Valve Co., Chicago, Ill. This valve is especially designed to overcome the difficulties due to water-logging, as well as other faults in the operation of air valves. The distinguishing feature of the valve is a hand vent. Any valve, it is stated, is subject to occasional waterlogging, that is, water held in the valve by a partial vacuum. With the Dole valve a pressure of the button relieves this condition. A bronze

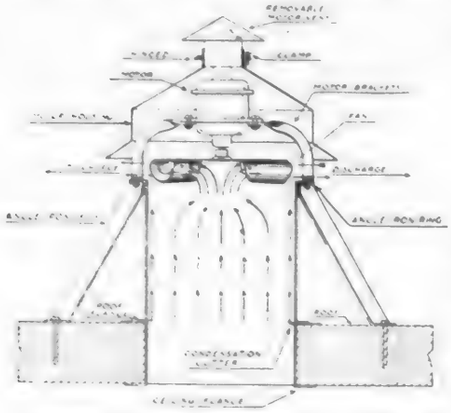
CONSTRUCTION OF DOLE SHURE-VENT AIR VALVE.

spring holds the vent seat in place. Other features include the double cap arrangement which forces downward all air escaping from the inner cap, designed to overcome the reason for the dust streaks on walls above air valves; and the float rest of drawn brass, shaped and soldered into the base to form a perfect rest for the float, yet giving free passage for draining water back into the radiator. Care is taken to align the bottom with the inlet to the valve to insure complete drainage of the valve. The valve is highly nickel-plated and polished.

BRINE SPRAY REFRIGERATION is the subject of an interesting bulletin, showing the application of this method to packing houses and featuring the system of the Atmospheric Conditioning Corporation, Lafayette Building, Philadelphia, Pa., the central feature of which is the Webster brine spray nozzle. This method of cooling, which is not unlike the principle employed in air washing, is shown to be of considerably greater simplicity than the method of refrigeration by brine coils or direct expansion of ammonia gas through coils in the cooling rooms. With the brine spray method, it is pointed out, there is a considerable saving in the salt bill, as well as in the power per ton of refrigeration, due to higher suction pressures allowable with the weak brine solutions used. There is a further economy in that with this method the shrinkage of the meat product is materially lessened, due to the higher vapor pressure maintained. A reprint of a paper by S. C. Bloom at the 1921 summer meeting of the American Society of Refrigerating Engineers accompanies the bulletin. Size of bulletin, 8½ by 11 in. Pp. 4.

FOUR-LEAF CLOVER VENTILATING SYSTEMS is the title of a series of bulletins on the unusual types of fans manufactured by the Centrifugal Fan Co., 9-15 Seventeenth Ave., Newark, N. J. Bulletin No. 1 is devoted to the use of Four-Leaf Clover exhaust fans for vertical installations, while Bulletin 2 covers the use of this type for outside horizontal installations. In each case numerous illustrations of typical installations are presented to

supplement the reading matter. The striking feature of the fan, which is of the centrifugal type, is its four double-roll blades secured to a metal disk which is directly connected to the motor. The motor being above the disc, the air is discharged horizontally and does not pass over or come in contact with the motor. This is characterized as especially advantageous where gases or other fumes have to be exhausted. When used in horizontal positions for exhausting purposes, the fan takes the place of the suction blower or exhauster used in connection with duct work. No housing is used, the



CONSTRUCTION OF FOUR-LEAF CLOVER EXHAUST FAN FOR VERTICAL INSTALLATIONS.

discharge being direct from the fan to the outside. The motor itself is protected from the weather by a metal hood. Size 4½ x 7 in. Pp. 16 and 12, respectively.

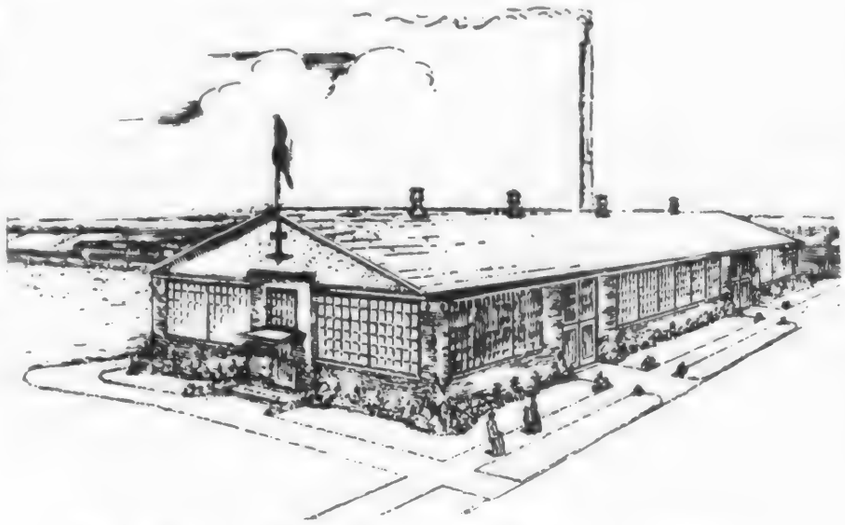
New Publications.

PROCEEDINGS OF THE NATIONAL DISTRICT HEATING ASSOCIATION for 1921 have been issued by Secretary D. L. Gaskill, Greenville, O. The volume, which contains no less than 300 reading pages, covers the papers, reports and discussions at the association's twelfth annual convention at Cedar Point, O., June 22-24, 1921. A list is included of the places and dates of previous conventions as well as a list of past presidents.

Among the items of special interest are the report of the Public Policy Committee, devoted to "Abandonment of Plants and Their Causes" and to "Commission Findings on Rates and Service", the report of the Meters and Accessories Committee, devoted to standard connections for condensation meters; papers on the use of powdered coal as fuel; report of the Committee on Rates; the paper by L. J. Pauley on the heating of the Guardian Building, Cleveland; and the paper by W. J. Kline on "Management and Operation of District Steam Heating Plants and Customers' Piping." President Hecht's notable address is published in full and will be found as timely today as when it was delivered. Size 6 x 9 in. Cloth pp. 299.

New Books.

Coal, Its Properties, Analysis, Classification, Geology, Extraction, Uses and Distribution, by Elwood S. Moore, dean of the School of Mines, Pennsylvania State College, brings together in compact form the salient facts and theories relating to coal, the data given being available for the practical man, the scientist and the layman. Many valuable maps are included showing the distribution of the various types of coal in practically every country of the world. The illustrations, also, have been drawn from a variety of domestic and foreign sources. The book contains 462 pages and 142 maps and figures, Size, 6 and 9 in. Cloth, $5.00 net. Published by John Wiley & Sons, 432 Fourth Avenue, New York, or can be obtained through the book department of THE HEATING AND VENTILATING MAGAZINE.



NEW PLANT OF THE MARSH VALVE COMPANY IN DUNKIRK, N. Y.

Deaths.

J. J. HOWLETT, of Kohlbry-Howlett Co., Chicago, Ill., heating and plumbing contractors, died in Miami, Fla., March 31, where he had gone for his health. He was 48 years old. Mr. Howlett was at one time superintendent of plumbing for the Hanley-Casey Co., and for the past twelve years has been a member of the firm of Kohlbry-Howlett Company.

ALBERT J. BROWN, president of the Farquar Heating and Ventilating Co., Indianapolis, Ind., died in Indianapolis March 29, following an operation. Although he had been identified with the Farquar company since 1912, Mr. Brown was widely-known as a preacher in the Friends' Church and at the time of his death was pastor of the Friends' Church in Marion, Ind.

SANITARY TIMES is the title of an ambitious house organ, published in newspaper form, by the Everhot Heater Co., Detroit, Mich., manufacturer of the Everhot line of water service heaters. It is a four-page publication, with its local news column, funny page of cartoons, woman's column "an' everthin' " that a modern daily carries. It is well written and the illustrations include a number of original drawings. Other house organs may well look to their laurels to maintain the standard and "pep" of their latest contemporary.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE published monthly at Cooperstown, N. Y., for April 1, 1922.

State of New York, County of New York, ss.:

Before me, a notary public in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, A. S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager: Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

A. S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stock holders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona-fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

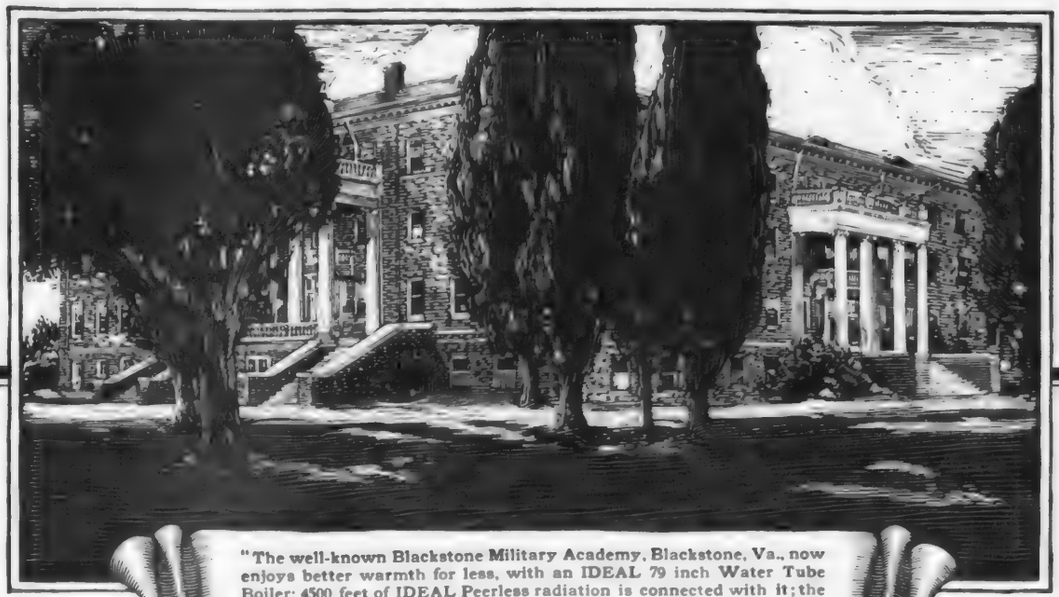
A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 27th day of March, 1922.

Louis Jacobs.

Notary Public, N. Y. County No. 72.

(My commission expires March 30, 1922.)



"The well-known Blackstone Military Academy, Blackstone, Va., now enjoys better warmth for less, with an IDEAL 79 inch Water Tube Boiler; 4500 feet of IDEAL Peerless radiation is connected with it; the boiler was installed by Branch & Andrews of Petersburg, Va."

Warmed by a Single Low Pressure Boiler!

THE BLACKSTONE MILITARY ACADEMY had an old heating plant. Last summer they decided to install a new system. They learned that *one* of our new IDEAL 79 inch Water Tube low pressure boilers would do the work of their *two* old ones.

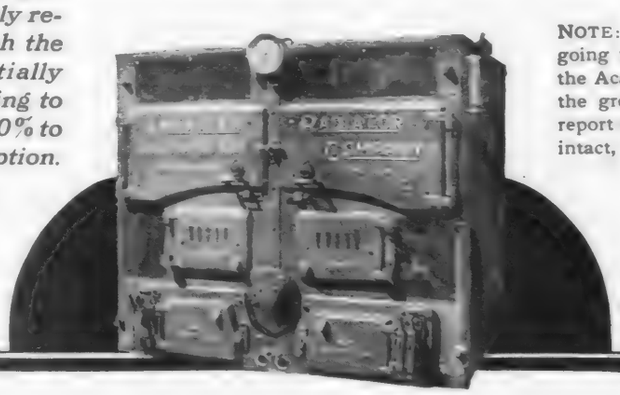
The boiler was installed. The first of the year the President, Col. Elvin S. Ligon, wrote:

"We are pleased in every respect with this boiler. It has proved economical of both time and fuel. We have been able to raise the heat in the morning in half the time formerly required; and although the season is only partially over we are expecting to show a reduction of 20% to 25% in fuel consumption.

"The boiler makes a good appearance and requires much smaller space in the boiler room."

The IDEAL 79 inch Water Tube Boiler is one of the newest products of our Institute of Thermal Research, designed to furnish adequate warmth to large apartment houses, schools, hospitals, theatres, banks and office buildings.

It has so many new and interesting points of construction that a booklet is necessary to present them fully. We urge every Heating Engineer and Architect to send for it. Your name on your letterhead sent to either address below will bring it.



NOTE: As this advertisement was going to press, word came that the Academy had been burned to the ground. Col. Ligon, in his report says: "we have the boiler intact, and expect to use it in our new building which we are planning to erect."

IDEAL Boilers are built to withstand most everything!

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

AMERICAN IDEAL RADIATORS BOILERS

104 West 42nd Street, New York Dept. 106 816 So. Michigan Ave., Chicago

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

RADIATION COMPUTING CHARTS.

The Croney Tables.

Note: The figures represented in the following sheets are compiled from data obtained from Nelson S. Thompson's "Mechanical Equipment of Federal Buildings," published by the Heating and Ventilating Magazine Company. All calculations made with the slide rule. Fractions above 0.5 added and all below 0.5 deducted. Wind leakage has been taken care of for ordinary cases and is based entirely on the window perimeter.

Special Leakage Allowance.

To find the allowance for leakage in any room in cubic feet of air per hour, raised from 10° to 70° F., multiply the total estimated radiation by the following factors:

BRICK WALL CONSTRUCTION.

Cubic feet per hour = 61 × square feet direct steam radiation.
Cubic feet per hour = 37 × square feet direct water radiation.

Radiation for Additional Leakage.

If it is desired to provide for a greater allowance than above use the following:

$$\text{Additional steam radiation} = \frac{\text{desired volume per hour}}{234}$$

$$\text{Additional water radiation} = \frac{\text{desired volume per hour}}{140}$$

STONE WALL CONSTRUCTION.

Cubic feet per hour = 47 × square feet direct steam radiation.
Cubic feet per hour = 28 × square feet direct water radiation.
Steam radiation figured at 250 B. T. U.
Water radiation figured at 150 B. T. U.

For Vapor Heating:

Take total direct radiation for steam and work out as follows:

$$\frac{\text{Total radiation} \times 250}{220} = \text{radiation for vapor.}$$

Add 2% per foot for ceilings over 12 ft. high and 20% to all ceiling radiators.

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

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EXAMPLE.

To find the amount of steam radiation in a room 12 ft. x 14 ft. x 10-ft. ceiling, 12-in. brick walls, air space, lath and plaster:

12-ft. side, facing the north.
14-ft. side, facing the east.
Each wall having one window, 4 ft. x 5 ft.
Ceiling exposed to an attic room having no heat.
Floor over an ordinary cellar.

North wall	12 ft. x 10 ft.	=	120 sq. ft. gross wall.
North glass	4 ft. x 5 ft.	=	20 sq. ft. glass.
			100 sq. ft. net wall.
East wall	14 ft. x 10 ft.	=	140 sq. ft. gross wall.
East glass	4 ft. x 5 ft.	=	20 sq. ft. glass.
			120 sq. ft. net wall.
Ceiling	12 ft. x 14 ft.	=	168 sq. ft.
Floor	12 ft. x 14 ft.	=	168 sq. ft.

RESULT.

North wall	100 sq. ft.	=	12 sq. ft. direct radiation.
East wall	120 sq. ft.	=	12 sq. ft. direct radiation.
North glass	20 sq. ft.	=	10 sq. ft. direct radiation.
East glass	20 sq. ft.	=	9 sq. ft. direct radiation.
Total			43 sq. ft. direct radiation.

On Data Sheet No. 13-I, Column 1, marked "Net Exposed Wall," locate 100. Opposite 100 and under "N. or N. W." read 12, which equals the amount of direct radiation for 100 sq. ft. of net wall.

On the same table, Column No. 1, marked "Net Exposed Wall," locate 120. Opposite 120 and under "E. or S. W." read 12, which equals the amount of direct radiation for 120 sq. ft. of net wall.

On Data Sheet No. 13-R, Column 1, marked "Net Exposed Glass," locate 20. Opposite 20 and under "N. or N. W." read 10, which equals the amount of direct radiation for 20 sq. ft. of glass. On the same table and under Column "E. or S. W." opposite 20 read 9, which equals the amount of direct radiation for 20 sq. ft. of glass.

Ceiling table (Data Sheet No. 13-II) equals top floor ceiling of residences, etc., and under "Area in Square Feet" we locate the nearest to 168, or 160. Opposite the 160, in Column A, we find 13 sq. ft., which equals the amount of direct radiation for 160 sq. ft. of ceiling.

In Floor Table (Data Sheet No. 13-LL) using the same process as worked out in Ceiling Table (Data Sheet No. 13-II) we get 2 sq. ft. of radiation.

Summary for direct radiation: 43 plus 13 plus 22 = 58 sq. ft. of radiation.

(The data Sheets referred to above will appear in June and succeeding issues.)

RADIATION COMPUTING—The Croney Tables. No. 13-H

Copies of this Data Sheet, printed separately, 5 cents each.

EFFICIENT HEATING
demands the JENNINGS PUMP

Duplex "D" Unit
Continuous Operation
Kings County Court House,
Brooklyn, N. Y.

Capacity each pump 40,000 square feet direct radiation air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 15 gives them in detail. Write for it.

THE
NASH ENGINEERING
COMPANY

Plant and General Offices
SOUTH NORWALK, CONN.

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DETROIT—Kerr Building
HOUSTON—Southern Pacific Building
INDIANAPOLIS—Hume-Mansur Bldg.
KANSAS CITY—Mutual Building
LOS ANGELES—218 East Third Street
MINNEAPOLIS—501 S. Sixth Street
MONTREAL—84 Inspector Street
NEW ORLEANS—521 Baronne Street
NEW YORK—350 Madison Ave.
PHILADELPHIA—Stock Exchange Bldg.
PORTLAND—224 Pine Street
PITTSBURGH—Oliver Building
SALT LAKE CITY—Dooly Building
SAN FRANCISCO—Sharon Building
SEATTLE—220 Railway Exchange
ST. LOUIS—Chemical Building
TOLEDO—136 Huron Street
TORONTO—Kent Building
WASHINGTON—710 14th Street N. W.

The NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 31-June 3, 1922.—Thirty-third annual convention of the Heating and Piping Contractors' National Association, in Buffalo, N. Y. Headquarters at the Hotel Statler.

June 6-10, 1922.—Mid-summer meeting of the American Society of Heating and Ventilating Engineers in Buffalo (June 6-7) and Detroit (June 8-10). Headquarters in Buffalo at the Hotel Iroquois and, in Detroit, at the Hotel Wolverine.

June 20-23, 1922.—Annual convention of the National District Heating Association, at Cedar Point, O. Headquarters at the Breakers Hotel.

May 16-17, 1922.—Annual meeting of the National Pipe and Supplies Association, in Pittsburgh, Pa. Headquarters at the William Penn Hotel.

June 6-8, 1922.—Fourth annual convention of the National Association of Master Plumbers in Detroit, Mich.

Miscellaneous Notes.

National Association of Brass Manufacturers will hold its next quarterly meeting in Detroit, Mich., May 23-25.

Burglar protection in the form of window ventilators that will permit the opening of windows without fear of intrusion is one of the talking points that are being advanced in connection with the sale of these appliances. A recent issue of the *Boston Post*, under the caption of "Burglars Undermine the Health; Crime Wave Compels People to Keep Fresh Air Out by Locking Windows," it is stated that "with the present crime wave going on, people have been worked into a frenzy to such an extent that they keep fresh air, which is the most necessary to them, out by shutting and locking their windows tightly. Many people, especially those living on lower floors, are compelled to keep their windows locked while they sleep, for fear of the porch climber. And those who are willing to take the chance find out to their sorrow that it does not pay. For most of those gentlemen that pick porch climbing for their profession are very light footed and successful, as we can see by the number of breaks that are reported daily.

The item then points out that ventilators are now being made that permit the windows to be left open and instances the Mazolok, made by the Console Sales Co., 60 Pemberton Square, Boston, Mass.

Cleveland, O.—A housing development, said to be without parallel in building history, and which will cost $30,000,000 to complete, is to be started on Shaker Heights within the next month, according to an announcement made by Josiah Kirby, who heads the development organization.

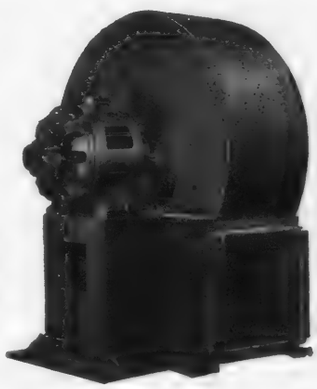
The development is to be a unique model apartment community, which will have its own central heating and ice plant, its own market, theater, public garage and business center, and, when

ONCE SPECIFIED REGISTERED AUTOVENT. ALWAYS USED

Autovent Fans —and— Uniblade Blowers

Note the accessibility to our protective type Brush Holders for commutator Protection.

ARE REPRESENTATIVE
of every Modern Improvement known to Electrical and Ventilating Engineering



OUR engineers have constantly kept in mind the importance of Low Power Consumption, Symmetry and compactness as well as the durability and quietness of operation.

THE finest obtainable materials have been patiently molded into form and skillfully assembled by master craftsmen to render the highest possible efficiencies known to fandom.

There is a size in stock—For your EVERY PROBLEM—
Ready for immediate shipment

AUTOVENT
FAN & BLOWER CO.
730-38 W. Monroe St. Chicago

Formerly
Batterman-Truitt Company

Branch Offices in Principal Cities

HAVE YOU A COPY OF OUR LATEST CATALOG?

completed, will afford facilities for the housing of more than 1,000 families.

The location is on both sides of Shaker Boulevard, from Morland Circle east to Coventry Road, and both sides of South Morland Boulevard from the Circle to South Woodland Road.

Plans for the big project became known following the purchase by Kirby and his associates of the land, a frontage of 8,400 linear feet, with a valuation of $2,500,000.

Ten million dollars is to be expended on apartments on both sides of Shaker Boulevard east of Morland Circle, another $10,000,000 on apartments and terraces on both sides of South Moreland Boulevard from the Circle to South Woodland Road and the remaining $10,000,000 in the business development on Shaker Boulevard west of the Circle and the market house, theatre and heating plants in Williams Avenue.

Harrisburg, Pa.—Widespread demand for a building code in Pennsylvania has necessitated a speeding up of the work on the tentative draft of such a code prepared by the Industrial Board, according to Commissioner Clifford B. Connelley. The draft is rapidly nearing completion, the third section of the code having been recently submitted to the general committee for study. The three sections thus far completed are those on assembly buildings, residence buildings and business buildings. Upon completion of section four, which deals with engineering requirements, hearings will be held on the entire code, probably in July, and the necessary revisions made so that the code as finally drafted may be put into operation.

Washington, D. C.—A committee has been appointed by the United States Chamber of Commerce to study and report on the subject of trade associations. The committee will try to determine in what manner trade associations can render the greatest service to business and the public. Philip H. Gadsden, of Philadelphia, president of the American Electric Railway Association, is the chairman of the committee. The other members are Thomas S. Adams, New Haven, Conn., secretary of the National Tax Association; Fred R. Babcock, Pittsburgh, president Babcock Lumber Co., Charles J. Brand, Pittsburgh, vice-president and general manager United Fruit Growers, Inc.,

Every Industry

Has its Peculiar Ventilating Requirement in Warm Weather

During the next six months there will be a demand for correct and economical ventilation which

ILG Self-Cooled Motor Propeller Fans and Universal Blowers

can furnish at a "most nominal" cost

Send for new indexed catalog fully illustrating modern heating and ventilating apparatus

GOOD HEALTH WEEK Oct. 23-30 1922

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Ventilation FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO., 2858 NORTH CRAWFORD AVENUE, CHICAGO, ILL.

"Buffalo" Automatic Electric Driven Sump Pumps

Typical Installation View of a Buffalo Automatic Electric Driven Sump Pump.

Hundreds in Successful Operation For Many Years

ABSOLUTE Reliability of operation for many years is assured by the splendidly rigid and self contained construction of Buffalo Automatic Electric Driven Sump Pumps.

The pump lifts out as a unit and when in place Sump cover may be packed against escaping steam or odors.

This reliability is augmented by automatically lubricated thrust ball bearings which require only an occasional *Oiling*.

It is further assured by enclosing shaft in frame casing of pump for protection, alignment and rigidity. This constuction permits lifting pump as a unit out of sump or sealing sump cover against escaping steam or odors.

Bulletin No. 959 describes these pumps in detail for both single and duplex pump installations.

Send for a copy.

Buffalo Steam Pump Company
Buffalo New York

"Buffalo" Heating and Ventilating Equipment

Birthplace of American Independence

Independence Hall is known the world over and signifies to each and every man that freedom which has become synonymous with the name of this fair country of ours.

When it was decided to install in this beloved building modern Heating and Ventilating equipment it was fitting that the best should be chosen.

Buffalo Duplex Conoidal Fans were the logical choice.

Buffalo Forge Company
Buffalo New York

Henry S. Dennison, Framingham, Mass., president Dennison Ffg. Co., James R. MacColl, Pawtucket, R. I., treasurer, Lorraine Mfg. Co., J. D. H. Morrow, Washington, vice-president of the National Coal Association; Alfred Reeves, New York, secretary of the National Automobile Chamber of Commerce; and George Rublee, New York, former member of the Federal Trade Commission.

Carnegie Institute of Technology, Pittsburgh, Pa., announces a wide variety of subjects for its summer session. Courses of six and eight weeks will be given in the College of Fine Arts, College of Industries, Margaret Morrison College and the College of Engineering. The eight-weeks' courses will run from June 26 to August 19. In addition to general engineering subjects, shop courses are offered in mechanical drawing, patternmaking, forge practice, machine shop, electric equipment, plumbing, oxyacetylene welding and sheet-metal work.

Washington, D. C.—The perpetual inventory, or stores control system, is strongly urged by the Fabricated Production Department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant. A practical treatise on the subject, which has just been issued by the department under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms.

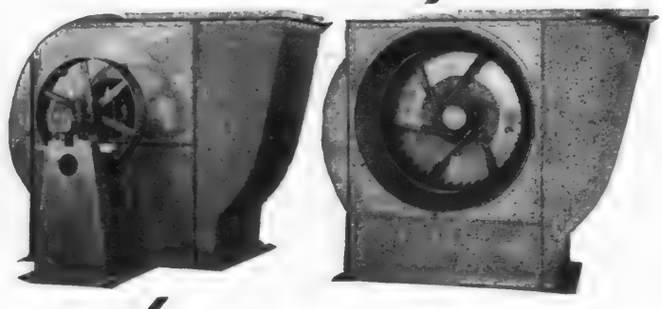
Washington, D. C.—Better fundamental conditions in business are shown in the latest figures received by the Department of Commerce for use in its "Survey of Current Business." Statistics of actual commercial and industrial movements during March, so far as they were available up to April 18, show a profound improvement over the condition a year ago. Two outstanding features, it is stated, of more than ordinary importance, are the marked increases in iron and steel activity and the big increase in construction.

Building contracts awarded in the 27 northeastern States during March, according to data compiled up to April 18, by the Department of Commerce, for use in its "Survey of Current Business," were valued at $293,637,000, compared to $177,472,000 in February and $164,092,000 in March a year ago. The figure for the last month was the largest recorded for any month in nearly two years. When account is taken of the decrease in the cost of building operations this means a very much larger volume of construction. The construction volume index of the **Engineering News-Record** increased from 100 for February to 202 for March, which gives some idea of the development in this industry. The value of contracts for residential building totaled $121,551,000, an increase of nearly $50,000,000 over February and far above any figure shown in the monthly record extending back for three years. Correspondingly large increases occurred also in business and industrial buildings and in public works and public utilities.

New York.—Announcement has been made by the Metropolitan Life Insurance Company that it has approved loans amounting to $2,750,000, to build 86 six-family apartment buildings, 48 two-family houses and 250 one-family houses in Norwood Gardens and Arleigh sections of Long Island City. The total operation, including the land, will come to more than $5,000,000. Accommodations will be provided for about 800 families.

W. M. Parlon, manager of the plumbing supply department of the Chicago branch of the Walworth Mfg. Co., Boston, Mass., was the victim of automobile thieves when he was shot and killed in Chicago, April 4. He was about to leave his car when he was accosted by two thieves who were being chased by the police. Upon his refusal to give up his car one of the thieves shot him and the bullet pierced his heart. He was 36 years old.

Philadelphia, Pa.—As a result of the report made by Dr. Thomas E. Finegan, State superintendent of schools, in which he declared that 74% of the public school buildings of Philadelphia were unsafe from a fire standpoint, as



LEHIGH

MULTIBLADE FANS

Where large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

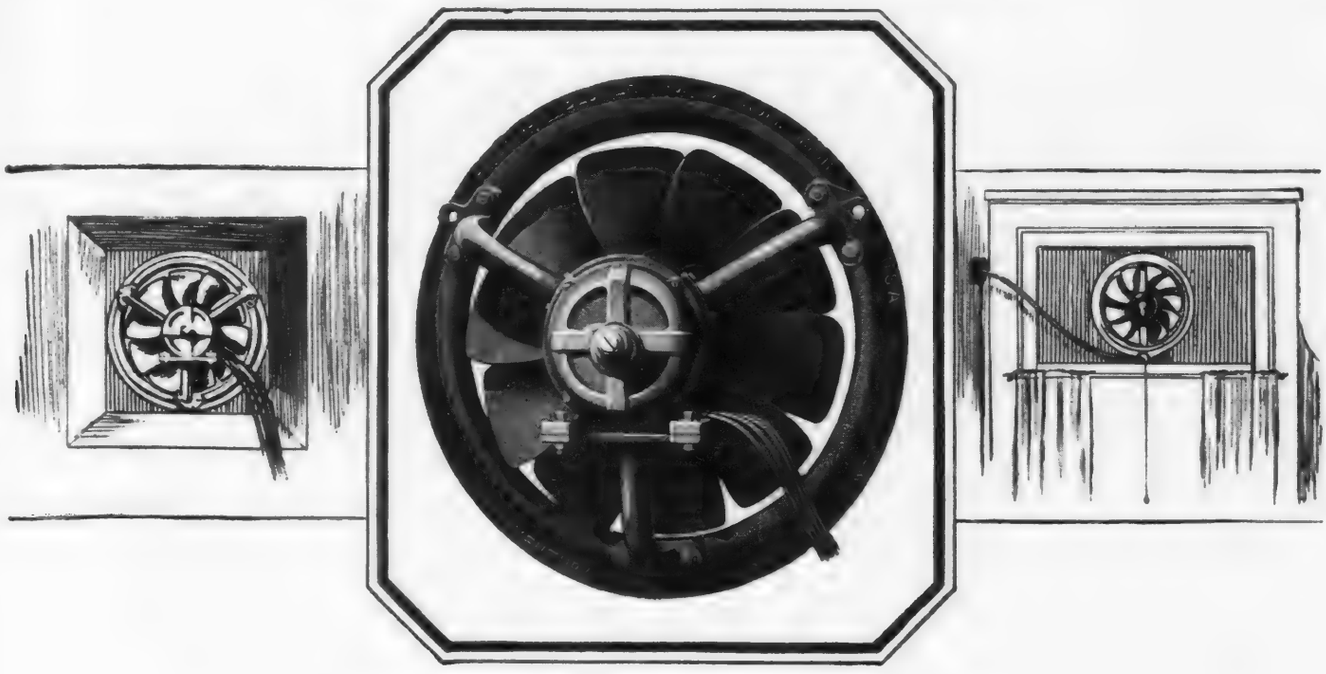
A study of the capacity tables and characteristic curves in the Lehigh catalogue clearly proves this fact.

To further substantiate this statement, your attention is directed to the large inlet and outlet, the cone shaped hub, the absence of stay-rods, the rigid construction secured by special blades running tangent from the hub to the periphery of the wheel and also various other details.

May we send you a copy of our catalogue?

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.



Banish Fumes and Gases—Expel Impure, Stagnant Air

"Sirocco" Ventura Fans Clear the Atmosphere—Bring in Clean, Outdoor Air

"Sirocco" Ventura Fans clear the atmosphere and are particularly adaptable to removing fumes, gases, and stagnant, impure air.

They are also used for exhausting dust-laden atmosphere—or to bring in fresh, clean outdoor air.

General cooling of offices, kitchens, factories or other buildings can be effected economically with "Sirocco" Ventura Fans.

We will gladly send you complete information regarding "Sirocco" Ventura Fans—tell you how they are solving the ventilation problem everywhere.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

"Sirocco" Products
TRADE MARK
BLOWERS · EXHAUSTERS · VENTILATING FANS · AIR WASHERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

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The Croney Tables.

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Floor over an ordinary cellar.

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East wall	14 ft. x 10 ft.	=	140 sq. ft. gross wall.
East glass	4 ft. x 5 ft.	=	20 sq. ft. glass.
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Ceiling	12 ft. x 14 ft.	=	168 sq. ft.
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RESULT.

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Total			43 sq. ft. direct radiation.

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On the same table, Column No. 1, marked "Net Exposed Wall," locate 120. Opposite 120 and under "E. or S. W." read 12, which equals the amount of direct radiation for 120 sq. ft. of net wall.

On Data Sheet No. 13-R, Column 1, marked "Net Exposed Glass," locate 20. Opposite 20 and under "N. or N. W." read 10, which equals the amount of direct radiation for 20 sq. ft. of glass. On the same table and under Column "E. or S. W." opposite 20 read 9, which equals the amount of direct radiation for 20 sq. ft. of glass.

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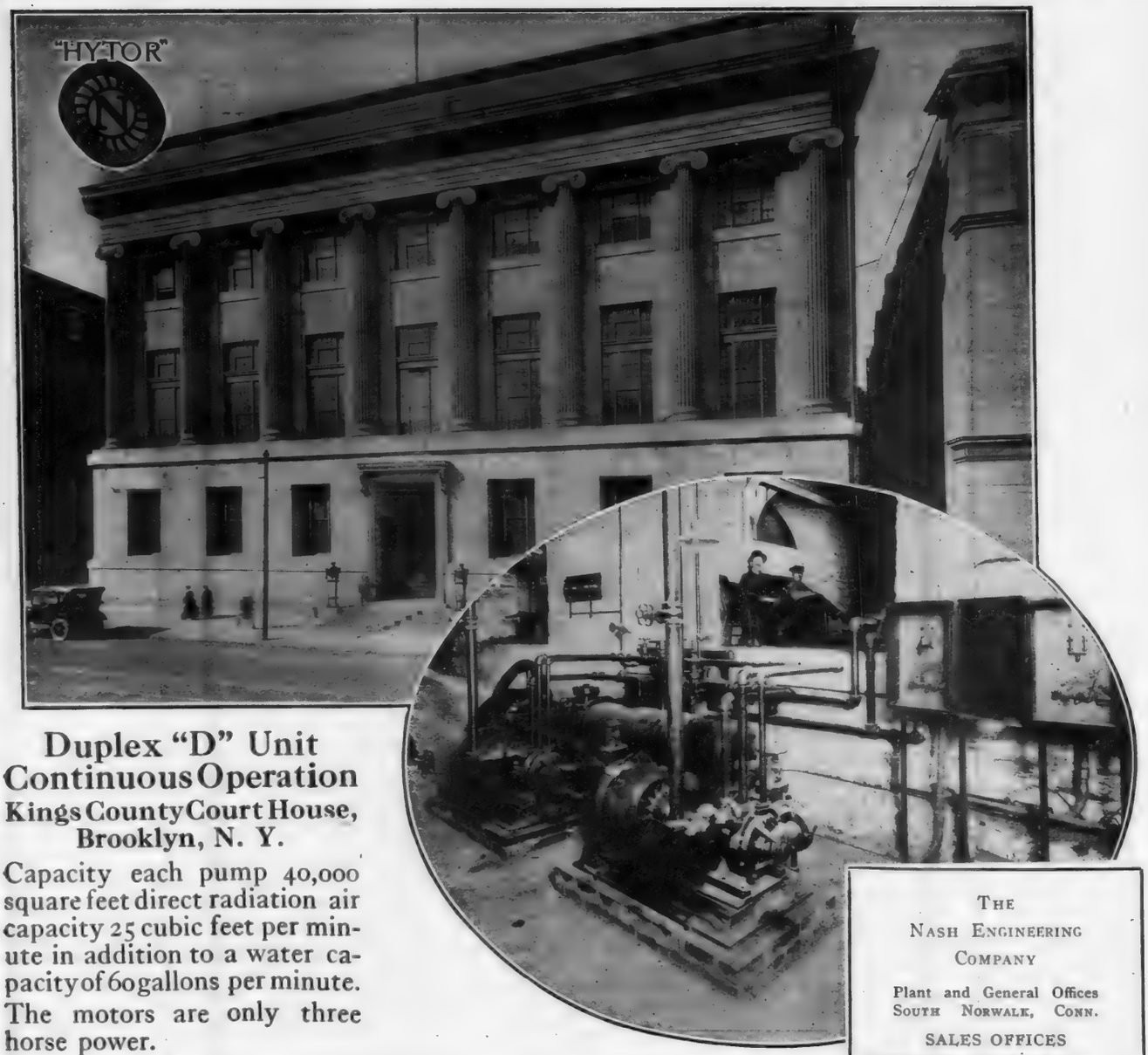
EFFICIENT HEATING
demands the JENNINGS PUMP



Duplex "D" Unit
Continuous Operation
Kings County Court House, Brooklyn, N. Y.

Capacity each pump 40,000 square feet direct radiation air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 15 gives them in detail. Write for it.

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The NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 31-June 3, 1922.—Thirty-third annual convention of the Heating and Piping Contractors' National Association, in Buffalo, N. Y. Headquarters at the Hotel Statler.

June 6-10, 1922.—Mid-summer meeting of the American Society of Heating and Ventilating Engineers in Buffalo (June 6-7) and Detroit (June 8-10). Headquarters in Buffalo at the Hotel Iroquois and, in Detroit, at the Hotel Wolverine.

June 20-23, 1922.—Annual convention of the National District Heating Association, at Cedar Point, O. Headquarters at the Breakers Hotel.

May 16-17, 1922.—Annual meeting of the National Pipe and Supplies Association, in Pittsburgh, Pa. Headquarters at the William Penn Hotel.

June 6-8, 1922.—Fourth annual convention of the National Association of Master Plumbers in Detroit, Mich.

Miscellaneous Notes.

National Association of Brass Manufacturers will hold its next quarterly meeting in Detroit, Mich., May 23-25.

Burglar protection in the form of window ventilators that will permit the opening of windows without fear of intrusion is one of the talking points that are being advanced in connection with the sale of these appliances. A recent issue of the *Boston Post*, under the caption of "Burglars Undermine the Health; Crime Wave Compels People to Keep Fresh Air Out by Locking Windows," it is stated that "with the present crime wave going on, people have been worked into a frenzy to such an extent that they keep fresh air, which is the most necessary to them, out by shutting and locking their windows tightly. Many people, especially those living on lower floors, are compelled to keep their windows locked while they sleep, for fear of the porch climber. And those who are willing to take the chance find out to their sorrow that it does not pay. For most of those gentlemen that pick porch climbing for their profession are very light footed and successful, as we can see by the number of breaks that are reported daily.

The item then points out that ventilators are now being made that permit the windows to be left open and instances the Mazolok, made by the Console Sales Co., 60 Pemberton Square, Boston, Mass.

Cleveland, O.—A housing development, said to be without parallel in building history, and which will cost $30,000,000 to complete, is to be started on Shaker Heights within the next month, according to an announcement made by Josiah Kirby, who heads the development organization.

The development is to be a unique model apartment community, which will have its own central heating and ice plant, its own market, theater, public garage and business center, and, when

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Autovent Fans —and— Uniblade Blowers

Note the accessibility to our protective type Brush Holders for commutator Protection.

ARE REPRESENTATIVE
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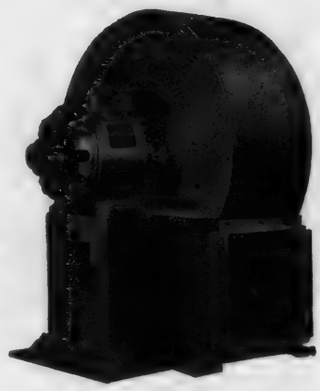
known to Electrical and Ventilating Engineering



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completed, will afford facilities for the housing of more than 1,000 families.

The location is on both sides of Shaker Boulevard, from Morland Circle east to Coventry Road, and both sides of South Morland Boulevard from the Circle to South Woodland Road.

Plans for the big project became known following the purchase by Kirby and his associates of the land, a frontage of 8,400 linear feet, with a valuation of $2,500,000.

Ten million dollars is to be expended on apartments on both sides of Shaker Boulevard east of Morland Circle, another $10,000,000 on apartments and terraces on both sides of South Moreland Boulevard from the Circle to South Woodland Road and the remaining $10,000,000 in the business development on Shaker Boulevard west of the Circle and the market house, theatre and heating plants in Williams Avenue.

Harrisburg, Pa.—Widespread demand for a building code in Pennsylvania has necessitated a speeding up of the work on the tentative draft of such a code prepared by the Industrial Board, according to Commissioner Clifford B. Connelley. The draft is rapidly nearing completion, the third section of the code having been recently submitted to the general committee for study. The three sections thus far completed are those on assembly buildings, residence buildings and business buildings. Upon completion of section four, which deals with engineering requirements, hearings will be held on the entire code, probably in July, and the necessary revisions made so that the code as finally drafted may be put into operation.

Washington, D. C.—A committee has been appointed by the United States Chamber of Commerce to study and report on the subject of trade associations. The committee will try to determine in what manner trade associations can render the greatest service to business and the public. Philip H. Gadsden, of Philadelphia, president of the American Electric Railway Association, is the chairman of the committee. The other members are Thomas S. Adams, New Haven, Conn., secretary of the National Tax Association; Fred R. Babcock, Pittsburgh, president Babcock Lumber Co., Charles J. Brand, Pittsburgh, vice-president and general manager United Fruit Growers, Inc.,

Every Industry

Has its Peculiar Ventilating Requirement in Warm Weather

During the next six months there will be a demand for correct and economical ventilation which

ILG Self-Cooled Motor Propeller Fans and Universal Blowers

can furnish at a "most nominal" cost

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GOOD HEALTH WEEK Oct. 23-30 1922

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"Buffalo" Automatic Electric Driven Sump Pumps

Typical Installation View of a Buffalo Automatic Electric Driven Sump Pump.

Hundreds in Successful Operation For Many Years

ABSOLUTE Reliability of operation for many years is assured by the splendidly rigid and self contained construction of Buffalo Automatic Electric Driven Sump Pumps.

The pump lifts out as a unit and when in place Sump cover may be packed against escaping steam or odors.

This reliability is augmented by automatically lubricated thrust ball bearings which require only an occasional *Oiling*.

It is further assured by enclosing shaft in frame casing of pump for protection, alignment and rigidity. This constuction permits lifting pump as a unit out of sump or sealing sump cover against escaping steam or odors.

Bulletin No. 959 describes these pumps in detail for both single and duplex pump installations.

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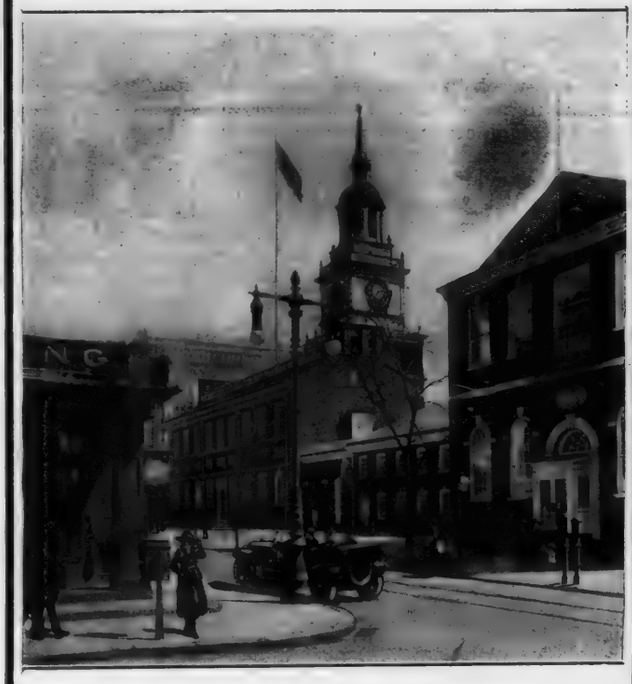
Buffalo Steam Pump Company
Buffalo New York

"Buffalo" Heating and Ventilating Equipment



Birthplace of American Independence

Independence Hall is known the world over and signifies to each and every man that freedom which has become synonymous with the name of this fair country of ours.

When it was decided to install in this beloved building modern Heating and Ventilating equipment it was fitting that the best should be chosen.

Buffalo Duplex Conoidal Fans were the logical choice.

Buffalo Forge Company
Buffalo New York

Henry S. Dennison, Framingham, Mass., president Dennison Ffg. Co., James R. MacColl, Pawtucket, R. I., treasurer, Lorraine Mfg. Co., J. D. H. Morrow, Washington, vice-president of the National Coal Association; Alfred Reeves, New York, secretary of the National Automobile Chamber of Commerce; and George Rublee, New York, former member of the Federal Trade Commission.

Carnegie Institute of Technology, Pittsburgh, Pa., announces a wide variety of subjects for its summer session. Courses of six and eight weeks will be given in the College of Fine Arts, College of Industries, Margaret Morrison College and the College of Engineering. The eight-weeks' courses will run from June 26 to August 19. In addition to general engineering subjects, shop courses are offered in mechanical drawing, patternmaking, forge practice, machine shop, electric equipment, plumbing, oxyacetylene welding and sheet-metal work.

Washington, D. C.—The perpetual inventory, or stores control system, is strongly urged by the Fabricated Production Department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant. A practical treatise on the subject, which has just been issued by the department under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms.

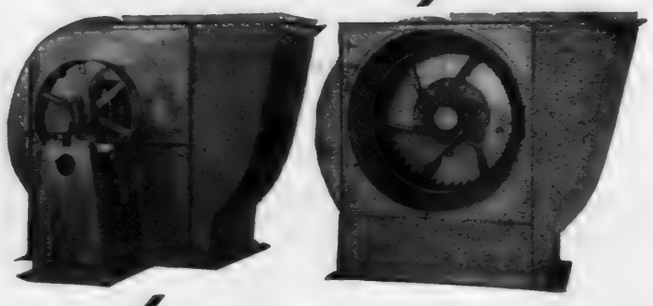
Washington, D. C.—Better fundamental conditions in business are shown in the latest figures received by the Department of Commerce for use in its "Survey of Current Business." Statistics of actual commercial and industrial movements during March, so far as they were available up to April 18, show a profound improvement over the condition a year ago. Two outstanding features, it is stated, of more than ordinary importance, are the marked increases in iron and steel activity and the big increase in construction.

Building contracts awarded in the 27 northeastern States during March, according to data compiled up to April 18, by the Department of Commerce, for use in its "Survey of Current Business," were valued at $293,637,000, compared to $177,472,000 in February and $164,092,000 in March a year ago. The figure for the last month was the largest recorded for any month in nearly two years. When account is taken of the decrease in the cost of building operations this means a very much larger volume of construction. The construction volume index of the **Engineering News-Record** increased from 100 for February to 202 for March, which gives some idea of the development in this industry. The value of contracts for residential building totaled $121,551,000, an increase of nearly $50,000,000 over February and far above any figure shown in the monthly record extending back for three years. Correspondingly large increases occurred also in business and industrial buildings and in public works and public utilities.

New York.—Announcement has been made by the Metropolitan Life Insurance Company that it has approved loans amounting to $2,750,000, to build 86 six-family apartment buildings, 48 two-family houses and 250 one-family houses in Norwood Gardens and Arleigh sections of Long Island City. The total operation, including the land, will come to more than $5,000,000. Accommodations will be provided for about 800 families.

W. M. Parlon, manager of the plumbing supply department of the Chicago branch of the Walworth Mfg. Co., Boston, Mass., was the victim of automobile thieves when he was shot and killed in Chicago, April 4. He was about to leave his car when he was accosted by two thieves who were being chased by the police. Upon his refusal to give up his car one of the thieves shot him and the bullet pierced his heart. He was 36 years old.

Philadelphia, Pa.—As a result of the report made by Dr. Thomas E. Finegan, State superintendent of schools, in which he declared that 74% of the public school buildings of Philadelphia were unsafe from a fire standpoint, as



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Where large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

A study of the capacity tables and characteristic curves in the Lehigh catalogue clearly proves this fact.

To further substantiate this statement, your attention is directed to the large inlet and outlet, the cone shaped hub, the absence of stay-rods, the rigid construction secured by special blades running tangent from the hub to the periphery of the wheel and also various other details.

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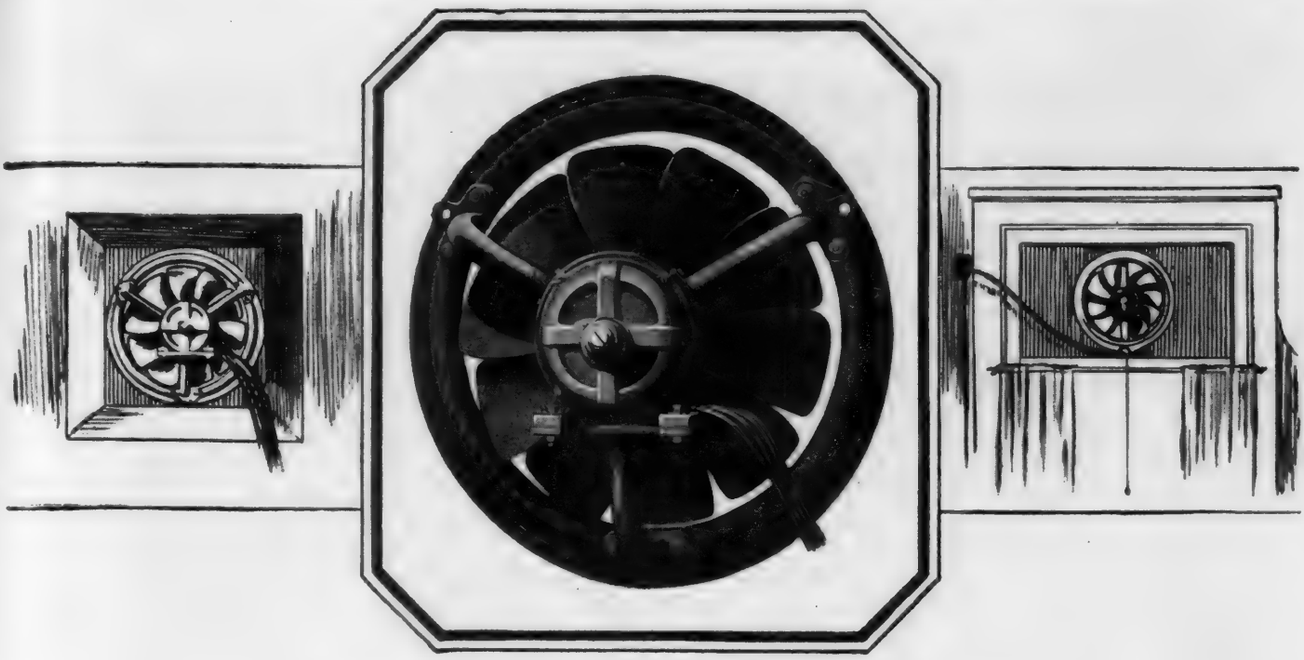

Banish Fumes and Gases—Expel Impure, Stagnant Air

"Sirocco" Ventura Fans Clear the Atmosphere—Bring in Clean, Outdoor Air

"Sirocco" Ventura Fans clear the atmosphere and are particularly adaptable to removing fumes, gases, and stagnant, impure air.

They are also used for exhausting dust-laden atmosphere—or to bring in fresh, clean outdoor air.

General cooling of offices, kitchens, factories or other buildings can be effected economically with "Sirocco" Ventura Fans.

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well as being unsanitary and inadequate, it is probable that a campaign of construction will be planned by the city's Department of Education, which will run into big figures. Already the Board of Education has laid out a building program involving the expenditure of upwards of $35,000,000, extending over a period of 20 years. At present more than $10,000,000 of School construction work is under way.

New York.—Statements that Samuel Untermyer, chief counsel of the Lockwood Committee, which has been investigating the construction business in New York during the past two years, is unduly prejudiced on the side of labor in the present controversy in the building trades, has brought forth a rejoiner from Mr. Untermyer that he has at no time committed himself on the question of wage scales or the justice of their reduction. At the same time he takes advantage of the opportunity to state that in many cases middlemen members of the Building Trades Employers' Association have been "adding from 50% to 279% to the cost of labor from which should be deducted, not to exceed 10%, for the appliances which are furnished by these brokers in labor, and another 20% which would be a generous but legitimate profit for handling labor." He then continues:

"This intolerable situation is due to criminal combinations among the employers thus trafficking in labor. That, rather than the comparatively insignificant item of one dollar per day, is the main item in the increased labor costs of building. When to this is added the abnormal increases in the cost of materials, due likewise to these same combinations, the position of labor is easily understandable."

Chicago, Ill.—Reports that the Chicago building situation is clearing up indicate that the Citizen's Committee to Enforce the Landis Award has held firm to its original policy. It is announced, for instance, that 81% of all building now going on in the city is being done by workmen paid according to the Landis scale. Up to April 1, 120 heating contractors and 34 plumbing contractors had formally signified their intention to conduct their shops under the Landis rules and wages.

Chamber of Commerce of the United States will hold its tenth annual meeting in Washington, May 16-18. The main topic for discussion will be "European Conditions and Their Effect on American Business." Under "Housing" will be discussed "Will Shoddy Construction Drive Investment Money Out of the Housing Market?"

Westward Trend of the manufacturing industry of the United States is discussed in the **Trade Record** of the National City Bank of New York. The manufacturing industry of the country, it is stated, is slowly moving from the place of its beginning, the Atlantic frontage, toward the great interior which produces the bulk of the manufacturing material and the fuel with which it is assembled and transformed into the finished form. The area occupying the Atlantic Frontage from Maine to Florida, the birthplace of our manufacturing industry, New England, the Middle States, the District of Columbia, Maryland, Virginia, North and South Carolina, Georgia, and Florida, produced in 1919, the latest census year, slightly less than one-half of the manufactures of the country as against more than two-thirds a half century earlier. The total outturn of the manufacturing establishments of the Atlantic frontage in 1919 was eleven times as much, in value, as fifty years earlier, while the outturn of the other parts of the country was 22 times as much as a half century earlier. In population, that other factor in manufacturing, the Atlantic states show an increase of 137% in the last fifty years, and the other sections of the country an increase of 205% in the same period.

International Chamber of Commerce will hold its next general meeting in Rome, Italy, the week of March 19, 1923.

Detroit Engineering Society, Detroit, Mich., at its annual meeting April 29, elected J. R. McColl, of McColl, Snyder & McLean, as its president for the ensuing year. Mr. McColl is also president of the American Society of Heating and Ventilating Engineers.

Associated Technical Societies of Detroit, Mich., has included among its

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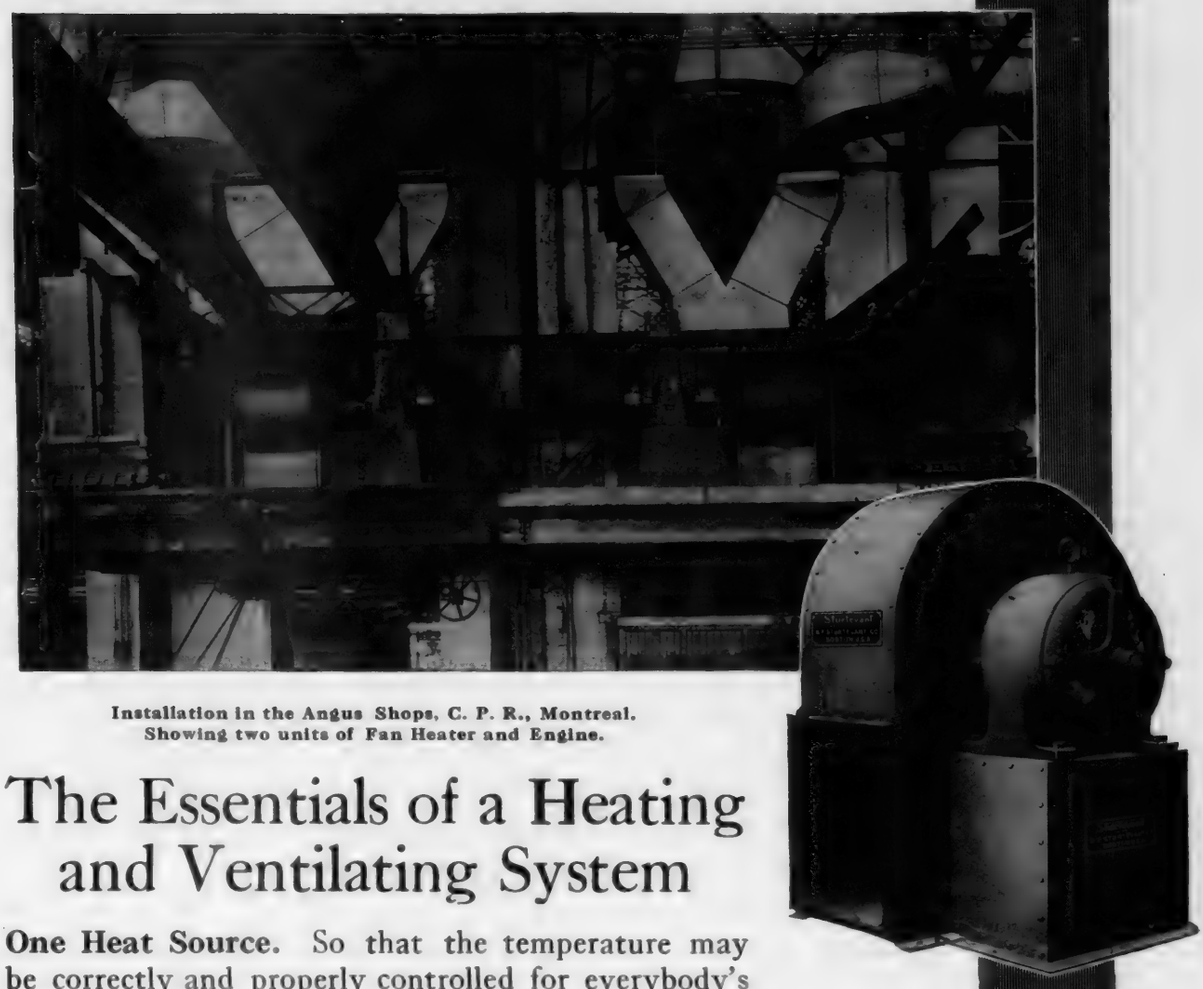

Installation in the Angus Shops, C. P. R., Montreal.
Showing two units of Fan Heater and Engine.

The Essentials of a Heating and Ventilating System

One Heat Source. So that the temperature may be correctly and properly controlled for everybody's comfort.

Flexibility. So that when more heat is needed it may easily and readily be supplied.

Low Initial Cost. "Hot blast" can always be installed at a lower cost than direct heating.

Low Operating Cost. When the Sturtevant System is engine driven, the exhaust steam may be used.

Low Maintenance Cost. Such a system will give long, continuous service at practically no maintenance cost whatsoever.

Ventilation. Sturtevant Systems may be used for ventilating —clearing fog, steam and smoke in the roundhouse.

Reliability. Sturtevant Heating and Ventilating Systems are as sturdy and enduring as your own equipment.

Write for further information

Sturtevant
PUTS AIR TO WORK

HYDE PARK
BOSTON, MASS.

605

standing committees one on Proposed Chimney Ordinance. The committee is made up of J. R. McColl, chairman; W. B. Stratton and L. Kamper.

Philadelphia heating and ventilating engineers have formed a local golf association. The organization meeting was held April 6 at the Engineers' Club, in Philadelphia, the call having been sent out on the initiative of R. C. Bolsinger. It was voted to call the organization the Heating and Ventilating Engineers' Golf Association, with the membership limited to 50. It is planned to hold seven meetings each season. Officers elected were: President George Gray; secretary and treasurer, R. C. Bolsinger. Directors: W. W. Rice, C. W. Stewart and W. H. Shelmerdine. The handicap committee will consist of W. G. Culbert, E. H. Giles and J. Morgan Kipe.

Central Station Heating Notes.

Bloomington, Ill.—In case the Illinois Commerce Commission permits the Bloomington & Normal Railway and Light Company to abandon its central water heating system, as has been petitioned, it is announced that the company will at once commence the installation of a steam system which will involve an expenditure of from $60,000 to $100,000. Property owners who are now using the company's service are objecting to the proposed change on the ground that they should not be required to make the additional expenditures necessary to re-pipe their buildings to make their equipment adaptable for steam. Years ago there were two rival companies in Bloomington, both having franchises for supplying central station heat, one using steam and the other hot water. Both companies were acquired by the McKinley interests which for years have operated both plants. The hot water pipes are now in poor condition and the company claims that it is cheaper to abandon them and lay new steam lines than to repair the hot water lines. A few of the company's customers will be cut off altogether if a change is made. The company, however, has presented evidence to show that the reduction in cost of heat with a steam system, will in from five to ten years pay back the cost of making the changes. An important factor in the situation is the fact that the city has an extensive paving program outlined for the year which involves streets in which there are water heating conduits.

Fairmont, Minn.—A central heating system is being proposed for Fairmont to cover both sides of Woodland Avenue, Brodt's addition, Homewood, Albion from Park Street northerly to Forest Street, and Park, from Albion, northerly to Forest. A meeting of citizens to discuss the project was called for April 7, when estimates were presented by Bain & Robb, of Milwaukee.

Des Moines, Ia.—Another extension of time has been granted to the Des Moines Electric Company for the construction of its heating plant. Under a franchise granted the company in February, 1916, a time limit was fixed and the council has twice before extended the limit.

Manufacturers' Notes.

Haynes Selling Co., Philadelphia, Pa., announces that William E. Scarlett, who has been connected with the company's engineering detartment for the past two and a half years, has joined the sales engineering force of the Keystone Supply & Mfg. Co., of Philadelphia.

American Radiator Co., Chicago, Ill., in carrying out its plans of revision in organization, has arranged to have its Vento sales interests cared for in the future by the general sales department and the relations with the blower companies will have the special supervision of Vice-President Charles K. Foster's office in Chicago. Among those retiring from the company, due to this change, are James H. Davis of the Chicago office and Frank K. Chapman of the New York office.

Warren Webster & Co., Camden, N. J., announces the opening of an office

TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

WHY NOT PATENT that money-saving device you originated for your own use? It may pay you well in money besides the satisfaction of having helped others. I make a specialty of patents, trade-marks and copyrights and have secured many for inventors and manufacturers. Honest advice through experience, prompt service, and painstaking consideration of my clients are what I have to offer.

Send for terms

LESTER L. SARGENT
524 10th St. (Cor. F) Washington, D. C.

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed. Our latest Booklet, "The Perfect Heating System," will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
PHILADELPHIA

Steam Traps Steam Separators Oil Separators Strainers
Air Traps Exhaust Heads Boiler Alarm Water Columns

WRIGHT AUSTIN

WA Standard with STEAM USERS SINCE '94

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Peerless Ventilator

The New York Blower Co.

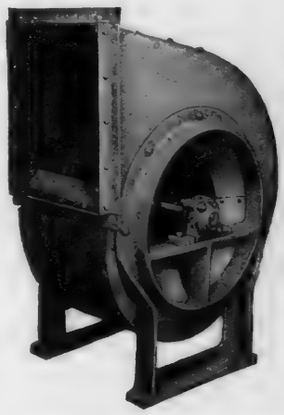
Chicago, Ill. La Porte, Ind.

Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

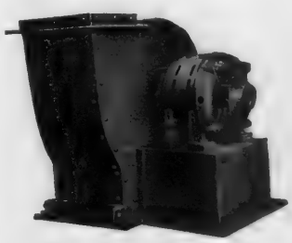
Motor Driven Propeller Fan

Slow Speed Planing Mill Exhauster

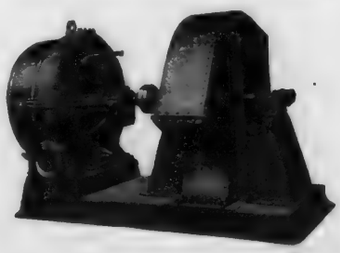
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

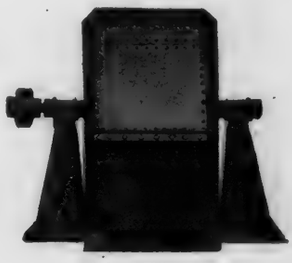
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

in Memphis, Tenn., at 714 Union and Planters Bank Building. It will be operated as a branch of the Company's St. Louis office and will be in charge of B. R. Hoshall.

Crane Co., Chicago, Ill., has opened new branches in New Orleans, Lima, O.; Pittsburgh and Cedar Rapids, Ia. The company has also purchased a building in Jacksonville, Fla., which will be opened as another branch as soon as it has been remodeled.

American Blower Co., Detroit, Mich., announces the resignation of J. D. Spurrier as manager of the company's standard apparatus division, to become associated with the Curtis Publishing Company, as Michigan advertising representative of the *Saturday Evening Post*.

Boynton Furnace Co., New York, is now occupying its new quarters at 58 West 40th Street, in the Banks Building. In addition to the company's display of Boynton boilers, furnaces and other heating apparatus, an interesting feature of the offices is the original sign used by N. A. Boynton, the founder of the Boynton Furnace Company.

American Radiator Co., Chicago, in its annual report, showed net earnings for the year ended December 31, 1921, of $3,168,326. After payment of the preferred dividend there remained $2,958,326 for the common stock, or 21.4%. This compares with $3,976,078 or 28.8% earned on the common stock in 1920. In his annual report, President Clarence M. Woolley states:

"While profits were gratifying, they were not consistent with those of former years. This, in part, was due to excessive overhead expense, which survived the war period of inflation. Commodities and labor have been in process of deflation, but it is difficult to bring the overhead into consistent relation. Adjustment of this fundamental problem involves abandonment of certain selling activities which, while profitable in pre-war years, are presently unprofitable because of the higher cost of their maintenance. New and less expensive methods are being established, and in due course the problem of overhead will be adjusted to meet demands of present economic conditions."

Central Foundry Company, Central Radiator Company and Molby Boiler Company, New York, and affiliated companies, are now located on the eighteenth floor of the Liggett Building, 41 East 42nd Street, New York. The show room of the Central Radiator Company and Molby Boiler Company, at 101 Park Avenue, has been discontinued. The new offices are in the heart of the uptown business district, with a subway station in the building and a direct indoor corridor connection with the Grand Central Terminal.

Patterson-Kelley Co., water heating engineers and manufacturers of heaters, is now located in its new and larger suite of offices in the Architects Building, 101 Park Avenue, New York, at the corner of 40th Street. The company has been in its downtown location, at 26 Cortlandt Street, for nearly a quarter of a century and its change of location is evidence of the trend of business towards the large terminals, as well as of its own growth which has made it necessary for the company to seek larger quarters.

Pierce, Butler & Pierce Mfg. Corp., New York, has appointed Arthur A. Kiewitz as advisory heating engineer in the Company's executive offices, which are now located at 41 East 42nd Street, New York. Mr. Kiewitz was formerly with the New York branch of the American Radiator Company.

Stark Sheet Metal Works Co., Canton, manufacturer of Mack ejector-ventilators, Air-o-matic ventilators and Perfecto damper regulators and indicators, announces that its products are now handled in Minneapolis, Minn., by the Morgan-Gerrish Company, of that city. The New York district will be covered in the future by James H. Davis, who will act as special representative for New York City and adjacent territory. The New York office is located at 1476 Broadway.

New Firms and Business Changes.

Noland Co., Inc., Winston-Salem, N. C., has succeeded the Roanoke Plumbing & Mill Supply Co., with offices at

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THE
PRICE
OF STEAM FITTINC
BY USING
CHITT ADJUSTABLE
RADIATOR HANGERS
THEY SAVE YOU TIME
MONEY AND LABOR
WRITE FOR CIRCULAR
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HEATING SPECIALTY CO.
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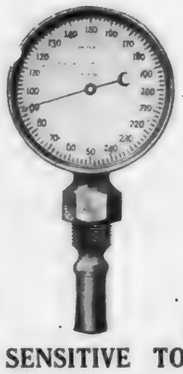
DEPENDABILITY!
SYNONYMOUS
WITH
STANDARD
"Metallic"
THERMOMETERS



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Standard "Metallic" Thermometers are built for long and reliable service—backed by our experience of nearly forty years as Thermometer Manufacturers—made in INDICATING or RECORDING type, with ANGLE or STRAIGHT STEM. Write us about your requirements or send for descriptive booklet. We have a variety of sizes and models from which you can select your STANDARD "Metallic" THERMOMETERS.

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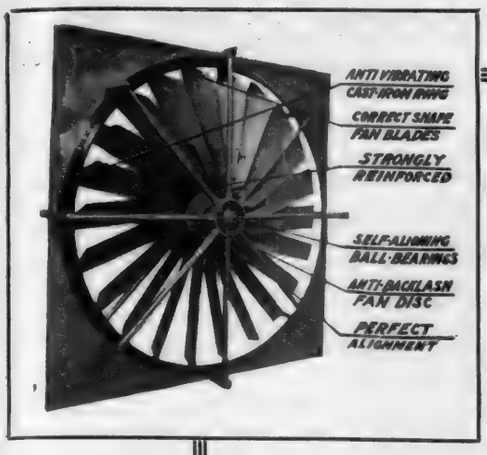
Clifton St., Boston 19, Mass.
Nearly Forty Years as Thermometer Manufacturers



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Everything known to make a better Fan has been embodied in the TYPHOON

Perfect Balance
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Reinforced Blades
Ample Center disc
Self-aligning Ball-bearings
Rugged Construction
Minimum Vibration

—AND—

The blade and angled cast-iron Ring that reduce windage to the minimum. Absolutely no "binding" between tip of blade and fan-ring from rebound—an exclusive **TYPHOON** feature.

Figure it out for yourself—it is easy to see why **TYPHOONS** are always given preference where low-pressure work is to be done with greatest economy.

TYPHOON FAN COMPANY

ERNST GLANTZBERG, President

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New Orleans Los Angeles | Chicago Dallas | Philadelphia Buffalo

220 South Liberty Street. The company will continue to handle steam and plumbing supplies, with increased facilities. E. T. Nance is local manager.

Galva Heater Co., Calva, Ill., has been sold by E. L. Yocum to C. H. Lyford, J. H. Boyd, Randolph Boyd and Miss Anna J. Anderson. J. H. Boyd has been elected president of the company. The new organization will continue to manufacture Galva heating boilers.

New Incorporations.

Reliance Heating Co., 3809 North Kimball Avenue, Chicago, Ill., capital $1,000 to install and deal in heating apparatus. Incorporators: John Lundquist, C. J. Kohlman, and George W. Lundquist. Correspondent, Summer & Summers, 79 West Monroe St.

Muscatine Heating and Sheet Metal Works, Muscatine, Ia., Capital $10,000. President, Frank J. Eisenmann; secretary and treasurer, Otto F. J. Kindler.

Lotz Asbestos Co., Hartford Conn., capital $100,000, to take over the asbestos pipe covering business of Collins-Lotz Co., of Hartford. Incorporators: John Lotz, Jr., Hartford; C. A. Jordan, Jr., Boston and Edward W. Broder, Boston. The company will maintain offices in Hartford and Boston.

International Blower Co., Inc., Hartford, Conn., capital $50,000, to manufacture fan and blower systems. Incorporators: S. Edward Kinney, M. E. Kinney and C. H. Kinney, all of Avon, Conn.

Contracts Awarded.

Victor Piping Co., Chicago, Ill., heating and ventilating Danville armory in Danville, Ill., for $21,018; the plumbing contract went to Carson-Payson Co., Chicago, at its bid of $8,669.

The Indictment of the Open Window.

The open window means dangerous drafts to pupils located in its vicinity. It means the ingress of large amounts of dirt and dust and noise from the street. It means an air supply that it is impossible to control, and the inevitable result of window ventilation in schoolrooms is no ventilation at all, with disastrous results on the health and welfare of the pupils.

A serious responsibility rests upon officials having the subject of school ventilation under their control, and they should be brought to a full realization of its importance. No window-ventilated school building should be allowed, no gravity or mechanical, direct or indirect, system, because experience and tests have demonstrated conclusively that satisfactory results cannot be obtained in this way. Every school should be equipped with a plenum system of ventilation, including air washer and both temperature and humidity control. — DAVID M. HAINES *before the National Association of Sheet Metal Contractors, in Pittsburgh.*

New York State Law Releases $100,000,000 for Building Construction.

Through the passage of the Lockwood Committee housing bills by the New York State legislature, building activities in that State have received an important impetus. The passage of one bill for instance, has made it possible for the Metropolitan Life Insurance Company of New York, to loan sums up to $100,000,000 for building purposes. The company has already announced plans to do this, if the necessary legislation were enacted.

The law, which is listed as S. I. 369, provides that until March 1, 1924, and for as long after that as the housing conditions mentioned in the emergency rent laws of 1920 and 1921 exist, a life insurance company may buy land, in a city of the first class (i. e., with a population of 175,000 or over), and may build apartments, tenements or other dwelling houses, not including hotels. The company may invest, in the land plus the improvements, not over 10% of the assets shown in its 1921 report. The cost of the land bought under this provision cannot be counted as an asset, unless it is improved with the kind of buildings here provided for; and the cost of the land and of the improvements cannot be counted for as an as-

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Not only do the Jenkins "Diamond" and signature identify genuine Jenkins Valves, but they symbolize a valve service and form Jenkins Bros. guarantee—an assurance of dependability and satisfaction, be the working condition severe or average. Valves of brass, iron, and steel for all requirements.
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First In Appearance
Quality and Service
The new "Genuine Detroit" Packless Radiator Valves, Bellows Type, are the result of years of experience in the design and manufacture of Radiator valves.
They are a high grade product of handsome design and are built for long life and freedom from trouble.
Where other valves leak and result in damage to surroundings—they do not do so.
Manufactured in all necessary styles and sizes for steam, hot water, vapor and vacuum heating systems. Let us send you booklet giving full information.
DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.

The Townhall of the League for Political Education, New York City.

Another New York Installation

The Town Hall for the League of Political Education is another of New York's recent structures in which the ventilating equipment is Westinghouse Motor-Driven.

Together with the Bankers' Trust Building, the Seaboard National Bank and the Mt. Siani Hospital, it represents a list of New York's latest and finest buildings. All are Westinghouse Equipped.

Westinghouse has a complete line of ventilating motors of all sizes, styles and types that are applicable to all industrial, private or public ventilating systems.

Westinghouse Electric & Mfg.Co.

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Offices in all Principal American Cities

Westinghouse

set, unless the average net rental of the buildings is not over $9 a month per room (Chap. 658).

Plain Words for the Construction Industry.

Some pretty plain words on outstanding problems of the construction industry were spoken by Secretary of Commerce Herbert Hoover in an address delivered before the Construction Conference of the National Federation of Construction Industries in Chicago, April 4. The department has been giving intensive study, during the past ten months, to the situation in the construction industry, as well as to the national needs in building and construction, the manufacture and distribution of materials to consruction, to its finance and to its condition of labor. The department has also been studying the forms of trades organizations and their practices.

"The practices of some small minority," declared Mr. Hoover, "are unendurable. They smear with shame the high standards of American business and labor, they drag in disrepute that vast majority of good men in these vital industries. This situation simply must be cleaned up. The Government can catch occasional crooks, but the cleaning can be done infinitely better by the decent men in the industry if they will organize to do it. It must be done if we would protect our business and commerce from the steady invasion of regulatory hands of the Government. I wish to emphasize again that the vast majority of men in these industries do not engage in these practices but some out of self-defense are forced into them by others.

"Second: A great field of service to the industry itself and to the country as a whole lies in the elimination of those great indirect wastes which are beyond the control of any one individual man or concern and can therefore only be accomplished by associated action. And if we would secure the housing and construction now so badly lagging behind our needs, we must cheapen its costs. It can be cheapened at a gain in stability to the industry and still hold high standards of living amongst the vast army of workers in the industry. Efficiency in industry is more important to the nation than the margins of profit or the rates of wages over which we do most of our quarreling.

"Third: To accomplish these ends, we need cleaner organization of the trades, not the destruction of trades organization. The initiative of the single individual is the most precious part of our whole economic fabric. But there are limits beyond which if we would make the full field of national efficiency, we must have cooperation between individuals. This is not a limitation of individual initiative; it is an extension of it. The restraint of crooks does not necessitate the restraint of constructive action for better business practices.

"In the matter of business and labor practices of the minority, I need not recite the repeated exposures in all directions that have sickened the public during the past twelve months. There are other things that have not yet been exposed. I have no taste for demagogic statements. I do have an aspiration for constructive remedies.

We need a cleaning up in the statistical work of the trade associations. Some kinds of this work stand condemned in the courts as a restraint of trade and against public interest, yet other kinds of statistics are in the interest of the public as well as in that of the trades themselves and have not been condemned."

WANTED

Position Wanted.—Sales engineer, three years' experience, drafting, estimating selling of heating and ventilating installations. Prefer to connect with sales agency or contractor. Address Box 16, care of Heating and Ventilating Magazine.

Wanted.—District sales representatives to handle line of blast heating and ventilating and air conditioning apparatus as a side line, or otherwise on liberal commission. State experience and qualifications. Address Box 12, care of Heating and Ventilating Magazine.

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Get This
FREE BOOK
It contains valuable information on air washing and conditioning, including temperature and humidity tables and examples of efficient air conditioning installations.
removes impurities from air used for heating and ventilating purposes. A complete conditioning unit increases or decreases the relative humidity of air and keeps its temperature practically constant throughout the year.
The Free Book explains how it accomplishes this. Send for your copy today.
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Multivane Fans—

Here's A Real Bargain— If You Act Quickly

Account change in size of our product, we have a limited supply of Multivane Fans—new stock, never been used—in perfect condition—(not war stock). Corresponding to manufacturers' Nos. 4, 5, 6 and 7, capacities of 4000 to 16000 C. F. M. against 1" S. P., top vertical discharge overhung wheel, single inlet pulley driven. Shipping point Chicago, Ill. Especially attractive prices for immediate disposal. Special proposition for entire lot.

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MASSACHUSETTS
Squirrel Cage Fans

We are specialists in the design and manufacture of fans and blowers for all purposes.

Let our Engineering Department co-operate with you in the solution of problems concerning ventilation, heating, drying, cooling, conveying, mechanical draft, and air conditioning.

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DETROIT, MICHIGAN
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HEATING SERVICE

For many jobs—

especially theatres, factories and laundries—the low pressure Monsoon Multiblade Disc Fan is the ideal type.

Low in cost and power consumption, high in air volume. Equipped with SKF self-aligning ball bearings.

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MULTIVANE FANS
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Heating and
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Apparatus
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Manufacturers since 1879
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WERE GOOD 20 YEARS AGO

Are Still BETTER Today.

Always Use Sprague in Your Ventilating System.

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REAL HOT WATER SERVICE

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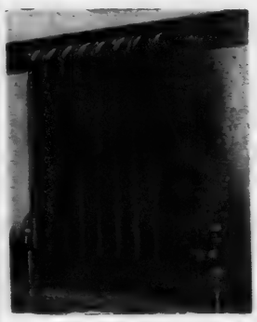
HARTMANN
RADIATOR BRACKETS



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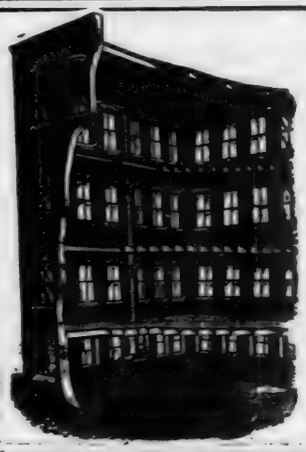

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Adapted for heating and ventilating large buildings. No need of distributing pipes. Takes full advantage of the laws of nature in the production of warmed air and utilizes these laws in providing an even distribution of warmth and comfort throughout the largest of buildings.

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Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

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Will not get out of order

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Made in various sizes and types to suit all conditions and requirements

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The hot water supply can be heated to the desired temperature with less steam with ALBERGER HEATERS, because both the water and the steam can circulate better, due to the extension of the heating element through the shell and the continuous drainage of the heater tubes. Designed for specified conditions. Write us for catalog now.

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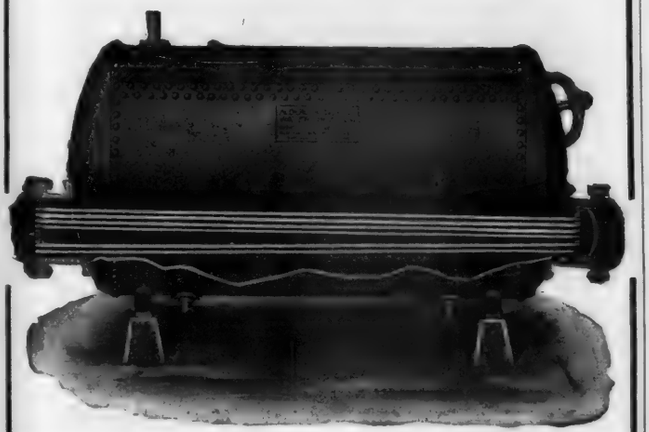

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In residences, office buildings, factories, churches, theatre, railway stations—steam is positively controlled at each radiator by an Adsco Graduated Radiator Valve. An Adsco Damper Regulator keeps pressure constant. 20% to 30% fuel saving. No air valves, no radiator traps, no return traps, no vacuum pumps are needed.

Ask for Bulletin No. 158-H which describes Adsco Heating for individual buildings. Bulletin No. 20-H describes Adsco Community Heating of a group of buildings from Central Station Steam Plant. Architects, engineers and heating dealers should also ask for Bulletin No. 159-H.

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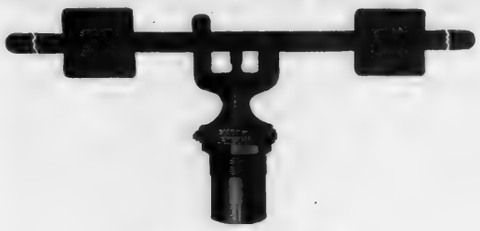
Adsco Graduated Radiator Valve gives positive control of steam

ADSCO HEATING

HOT WATER



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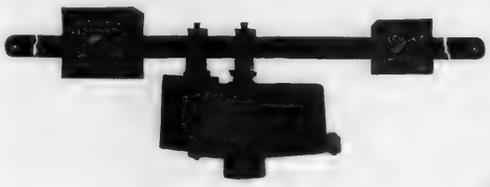

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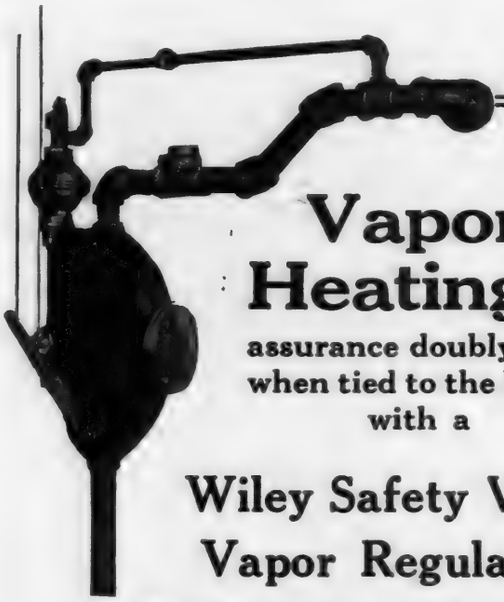

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assurance doubly sure when tied to the boiler with a

Wiley Safety Vent Vapor Regulator

Write for your copy of booklet describing the Wiley line of vapor heating specialties.

A peerless quality product manufactured and sold exclusively by

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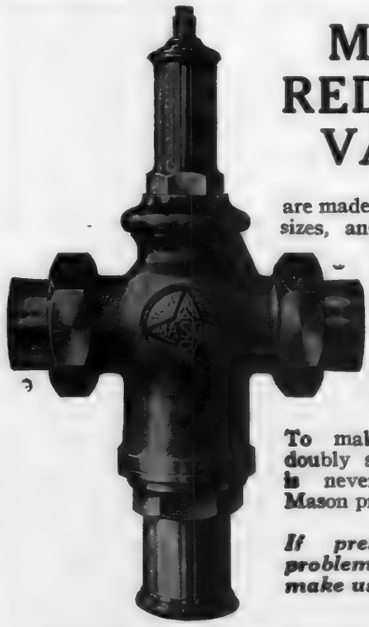
Mason Reducing Valves have an extraordinary reputation for three things—long life, continuous service and reliability, which is, after all, only a natural tribute earned through merit



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are made in many types and sizes, and every type and every size can be depended upon to reduce and maintain pressure at the proper delivery point, regardless of the fluctuation in the initial pressure.

To make your assurance doubly sure, Mason service is never separated from Mason products.

If pressure regulation problems trouble you, make use of our service.

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Quick Opening
Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically reenforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

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Have opposing seats.

Can be used on either pressure or vacuum systems.

Perfect in every detail.

CAPITOL PRODUCTS ALWAYS SATISFY.

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Read these Features of
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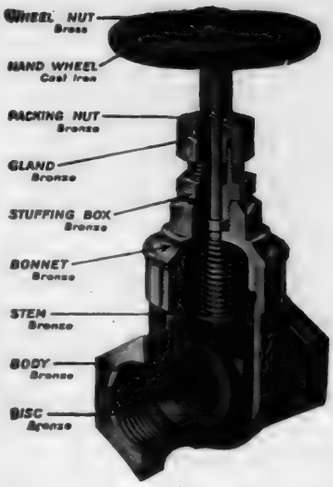
Bronze Valves



1. Wheel is held on by a nut, a much better construction than merely peening over the end of the stem. The Kennedy method permits the wheel to be lined up properly, eliminates the danger of losing the wheel during transit, and makes removal of the wheel possible and easy in service. Repacking a valve is much easier with the wheel removed.

2. Stem of special bronze of very high tensile and torsional strength.

3. Gland in stuffing box—an optional feature at slight additional cost, which keeps the packing nut from turning with the stem, avoids frequent repacking and makes the packing do good work until it is almost entirely used up.

4. Bonnet has a hexagonal shaped nut, which costs us more, but is much more satisfactory than a square wrench hold.

5. Body is semi-spherical or well-rounded which in comparison with a sharp cornered body, is the strongest obtainable with a given weight of metal.

6. Reinforcing ribs stiffen the body to withstand piping and service strains.

7. Pipe threads are of generous length. Short pipe threads mean that if a pipe is screwed in a little more than the average, it may press against the seat and the resulting distortion will promote leakage.

8. Discs are made solid in 3-in. and smaller sizes and double discs of three different styles are used in the larger sizes. This gives a proper choice for every service condition.

9. The discs of the double disc types cannot be replaced wrongly. Just because you have been lucky enough to escape trouble from valve discs replaced wrongly, don't get the idea that it can't happen or that it is unimportant.

10. Accurate guides for seat prevent contact of disc with seat until the valve is ready to close.

A satisfactory and permanent solution to the problem of good service from bronze valves depends largely upon your starting with the right valves. The selection of Kennedys assures good service. Write for the Kennedy Catalog to help you make a selection for trial. 251

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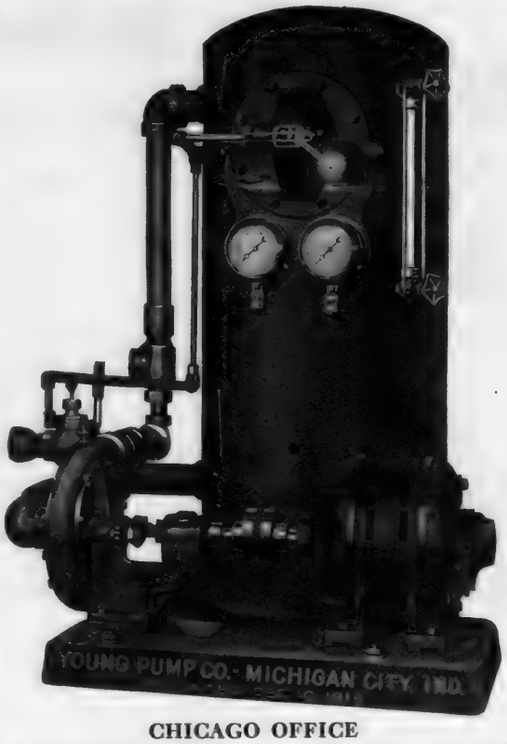
Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

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DAHLQUIST COPPER BOILERS

translated in terms of service mean—
Durability, Reliability
hence—

ECONOMY

Let us figure on your requirements

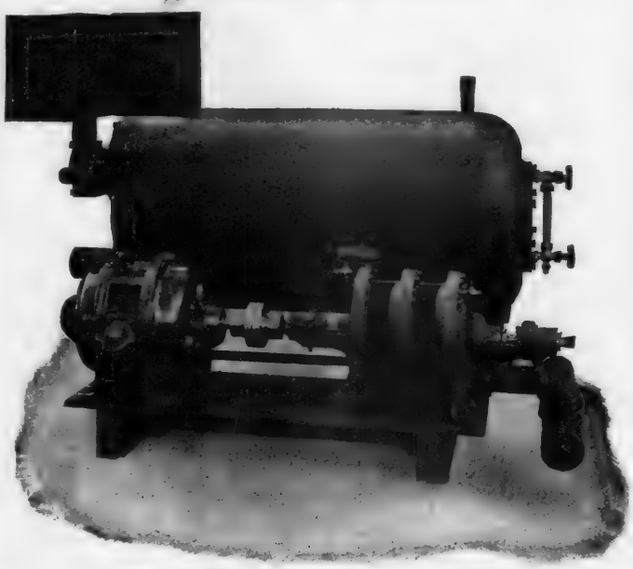
DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

Constructed to insure long life.
Superiorily proven by years of experience.

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YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.
Canadian Representatives: Darling Bros., Ltd., Montreal

TRADE MARK STERLCO

The Sterling Slide Valve Return Trap

Patent applied for

Will thoroughly drain return lines of heating systems, eliminate air without loss of vapor and return water to the boiler against pressure.

It will lift liquids to a higher level where steam or air pressure is available.

It can be placed as low as 3 inches above the water line of the boiler, thus making it possible to install vapor systems in basements with low ceilings.

A cure for sick Vapor Heating Jobs

STERLING ENGINEERING CO.
419 Third Street MILWAUKEE WISCONSIN

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UNION COMPOSITE DISC VALVE

UNION DISC RADIATOR VALVES

Offset corner with male union

Made to suit every Requirement, with Unions and wood wheels, in Globe, Angle, Corner and offset patterns.

NOTE THE UNION BONNET CONSTRUCTION
Specify "POWELL" VALVES

Ask your dealer for Powell Valves or write us

The Wm. Powell Company
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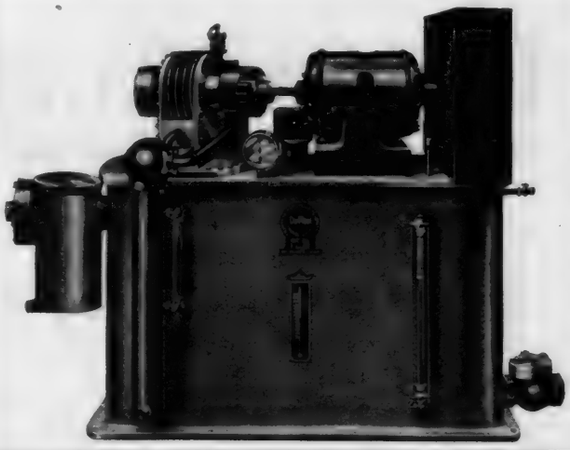


Cut Your Power Bills In Half

Use Du Moin Return Line Vacuum System

THE DU MOIN is the one NEW discovery in return line pumps in twenty years.

It works on a different principle. It pumps no hot water. Instead it draws the hot water back into a tank by maintaining a vacuum in the tank. Then it automatically reverses, puts the tank under pressure, and forces the water back into the boiler.

Forcing the water into the boiler on ordinary jobs takes about half a minute. Creating the vacuum again takes another half minute. Then the pump automatically stops and for an average of about 9 minutes vacuum is maintained without power. Power is used only when actually needed.

Actual power consumption is just about half that of the leading standard systems now in use.

Thompson's Du Moin Vacuum Return Line Pump

Investigate—Write today for Bulletin 7 with full explanation sizes, ratings and prices.

Thompson Mfg. Co.
813 West 24th St. Des Moines, Iowa

Banner Rock Wool Jacket

FORMERLY KNOWN AS

BANNER ROCK WOOL QUILT

The same unequalled hot surface insulation adaptable for insulating Tanks, Tank Cars, Boilers, Heaters, Stills, Ovens, Kilns, etc., manufactured under the same patents by the same concern.

"Information is still available"

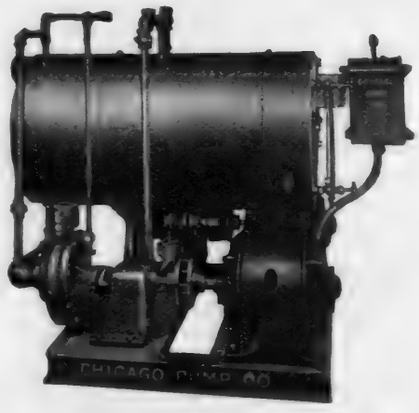
SOLE MANUFACTURERS

BANNER ROCK PRODUCTS COMPANY

ALEXANDRIA INDIANA

Return Line Vacuum Pump

Each Pump Separately Controlled



Each Run Only as Needed

A return line vacuum pump that handles air and water individually, eliminates the waste of continually running two pumps when only one is needed. This is truly efficiency and economy.

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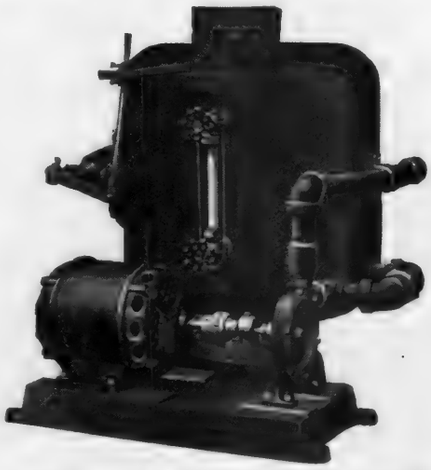
WESTERN AUTOMATIC ELECTRIC CONDENSATION PUMP and RECEIVERS



RELIABLE **SIMPLE**

A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

Write for Bulletin No. 220

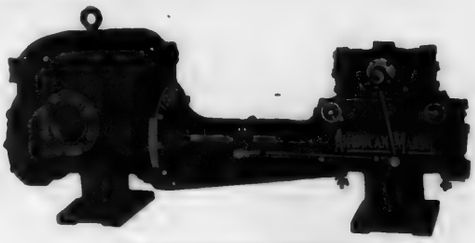
WESTERN ENGINEERING CO.

DAVENPORT, IOWA

American-Marsh Pumps

for Heating Systems

For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

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AMERICAN STEAM PUMP CO.
Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"

Stop this!

Smoke Means Waste!

A smoke-belching stack means needless, senseless waste. Smoke shows energy unused,—money thrown away,—dirt, soot, grime. Architects and engineers who include in their specifications the time-tested

Twin-Fire
HAND STOKER
"It Burns the Smoke"

Pave the way for maximum efficiency, maximum economy and an absolute minimum of waste up the chimney.

READ THIS RIGID WARRANTY

The Twin-Fire Hand Stoker is installed everywhere with the understanding: that it will *double* the furnace temperature with *less fuel* over the ordinary setting, that it will save 10 to 30 per cent fuel, prevent smoke, increase boiler power, eliminate dirty tubes and burn any grade of coal. Twin-Fire Hand Stokers can be installed under boilers from 50 to 1000 H. P.

BURN THE SMOKE!
Book Tells How

WRITE TODAY FOR FREE BOOK

Learn all about the superior feature of construction which means complete combustion of volatile gases. Just ask for "The Story Behind Twin-Fire Hand Stokers." Convenient size for your data files. Cramful of facts and figures. Just address

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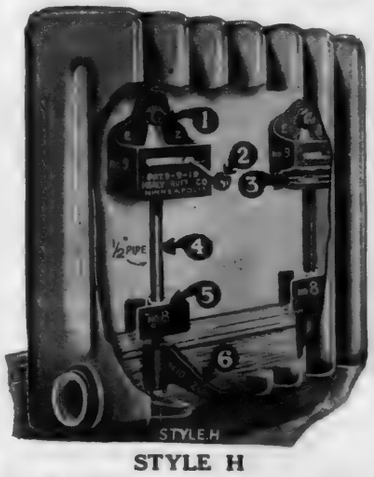
1253 1st National Bank Bldg., Chicago
"Successful Furnace Builders Since 1898"

SIX IMPORTANT FEATURES

of

E-Z

RADIATOR HANGERS



STYLE H

1. One Bolt
2. Invisible Washer
3. Horizontal Adjustment
4. Vertical Adjustment
5. **Adjustable for Baseboard**
6. Made for Wall, and Column Radiation

STYLE R
Without Baseboard Adjustment
Reasonable Price

Made for all styles of radiation

Manufactured by
HEALY-RUFF CO.,
Minneapolis, Minn.

Full Complement of Building Pumping Units

Automatic, Centrifugal, Vacuum and Boiler Feed Pumps

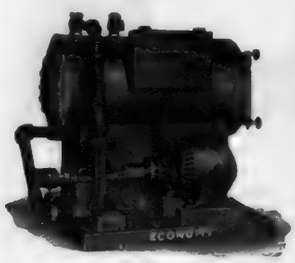
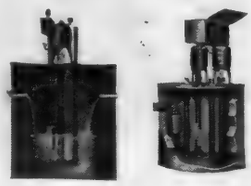


Fig. 2234

Capacities, 2500 to 65000 square feet direct radiation per standard single units.

Self Contained
High Class—Dependable

Cellar Drainers, Bilge and Sump Pumps, Sewage Ejectors



Duplex Single

Capacities, 7 to 3000 gallons per minute.

Duplex Units, Double Capacity

Made in several types and specially designed to meet all conditions.

Automatic Condensation Pumps and Receivers

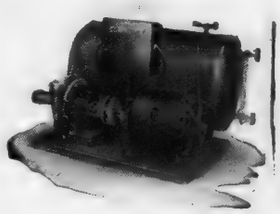
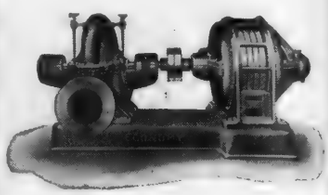


Fig. 2176

Capacities, 1000 to 125000 square feet

Made in following types: Horizontal, Vertical, and Underground. Also Piston types for extreme pressures.

Centrifugal Pumps for all purposes



Made either Single or Multi-stage

Boiler Feed house device. Hot water heating and Ice water circulating pumps.

All capacities and pressure from 5 to 5000 gallons per unit.

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Surface Barometric and Jet Condensing Equipments for Power Plants.
Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service.
Distilling Condensers for Refrigeration and Chemical Plants.

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Ross Boiler Feed Water Heaters.
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THE BRAND THAT LEADING ENGINEERS DEMAND

$34.20 COMPLETE

Price is net.

Sold with an absolute guarantee.

We also make a regulator for higher pressures. Also, Reducing Valves; Pump Governors; etc.

Ask for Junior Catalog No. 21

VICTOR Damper Regulator

For Boiler pressures up to 25 pounds.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

281 South Street Newark, N. J.

The Best Heating System Regulator

Davis—

Water Control Valve
Back Pressure Valve
Balanced Valve
Stop and Check Valve
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Fluid Level Controller
Float Valve
Steam Trap
Many others

DAVIS Regulators are reliable—once set, they will maintain any desired pressure, regardless of fluctuations in the steam supply. Their action is as certain as gravity because they are gravity-controlled by weighted lever arm.

There are a number of types—all are widely used in heating systems. One that finds extensive application is the famous Davis P & W Regulator, shown at the left, for use on any low pressure or vacuum system of steam heating where the delivery pressure to be maintained does not exceed five pounds.

Write the G. M. Davis Regulator Co., 436 Milwaukee Avenue, Chicago, for details of the money-back guarantee. Ask for descriptions of the specialties listed at the left.

DAVIS VALVE SPECIALTIES

STEAM SAVERS SINCE 1875

PYRO-BESTOS

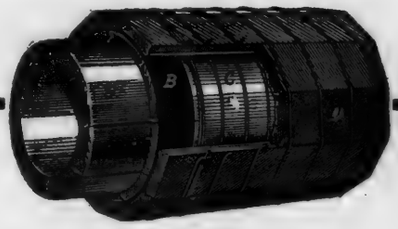
Underground Pipe Insulation

For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems.

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

National Asbestos Mfg. Co.
163-193 Henderson Street, Jersey City, N. J.



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

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A. WYCKOFF & SON CO.
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FOR UNDERGROUND STEAM OR HOT WATER PIPES
THE ORIGINAL
RIC-WIL METHOD

embodies more original ideas, more advanced engineering, and more good practical features than any other system on the market. The material, construction, installation methods and practical results which, combined, form what we call the RIC-WIL Method, appeal with equal force to the engineer, to the practical operating man and to the business executive. Let us send you a copy of our descriptive Bulletins 1-3. Write to-day.

The RIC-WIL COMPANY
CLEVELAND

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BAILEY FLUID METERS record and totalize the flow of steam at any pressure or temperature, boiler feed, condensate, circulating water, or, practically any fluid flowing in a pipe. These meters are ideal for the measurement of low pressure steam as used for heating, because pressure and temperature records may be included on the same chart, giving the complete story of the steam supply.. This makes it possible to calculate the actual B. T. U. supplied to a customer, and is conclusive evidence in case of any question regarding the supply. The pressure compensator has been in service for some little time. This device automatically corrects the totalizer readings for pressure changes, so that actual steam flow may be read directly from the meter.

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Other Types of Meters as well as Recording and Indicating Gauges are made for different purposes, and nearly any problem in connection with the metering of fluids can be handled. Descriptive Bulletins sent on request.

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Typhoon Fan Company, New York.
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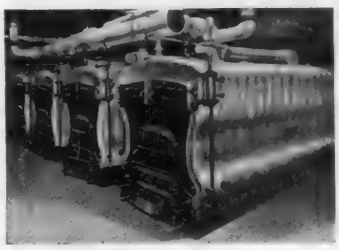

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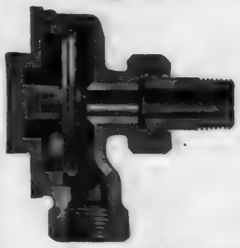

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American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Standard Thermometer Co., Boston, Mass.

WATER.
Marsh & Co., Jas. P., Chicago, Ill.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

TRAPS.
McAlear Mfg. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

RADIATOR.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

RETURN.
American Blower Co., Detroit, Mich.
Dunham Co., C. A., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

STEAM.
American Blower Co., Detroit, Mich.
American Steam Gauge & Valve Mfg. Co.,
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Patterson-Kelley Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.

VACUUM.
American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, (Steam.)
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

TURBO-BLOWERS
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

UNDERGROUND PIPE CONDUITS.
American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
National Abestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

VACUUM CLEANING APPARATUS.
American Radiator Co., Chicago, Ill.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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AIR (Automatic).
American Radiator Co., Chicago, Ill.
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Wm. S. Haines & Co., Philadelphia, Pa.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
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Jenkins Bros., New York.
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Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Webster & Co., Warren, Camden, N. J.

BACK PRESSURE.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

BALANCED.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
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Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.

BLOW-OFF.
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Jenkins Bros., New York.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

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The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

GATE.
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Crane Co., Chicago, Ill.
Jenkins Bros., New York.
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Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
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Jenkins Bros., New York.
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Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
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Crane Co., Chicago, Ill.

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Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
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Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Capitol Brass Works, Detroit, Mich.
Commonwealth Brass Corporation, Detroit, Mich.
Crane Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
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McAlear Mfg. Co., Chicago, Ill.
Marsh Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Erie, Pa.
Mouat-Squires Co., Cleveland, O.
O-E Specialty Co., Milwaukee, Wis.
Simmons Co., John, New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
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Trane Co., La Crosse, Wis.
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Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
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Fulton Co., Knoxville, Tenn.
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STOP AND CHECK (See Valves, Non-Return.)

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Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Massachusetts Blower Co., Watertown, Mass.

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Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
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Garden City Fan Co., Chicago. Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
H. W. Nelson Co., Moline, Ill.
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Skinner Bros Mfg. Co., St. Louis, Mo.
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L. J.Wing Mfg. Co., New York.

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Buffalo Forge Co., Buffalo, N. Y.
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New York Blower Co., Chicago, Ill.
Stark Sheet Metal Works Co., Canton, O.
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Hersh Brothers Co., Allentown, Pa.
Knowles Mushroom Venilator Co., New York.
New York Blower Co., Chicago. Ill.

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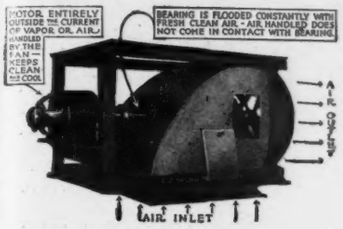
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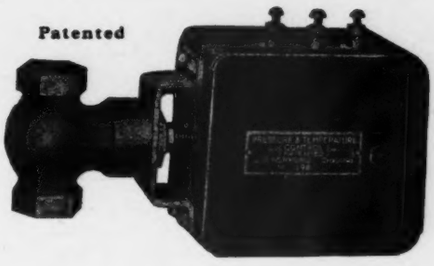

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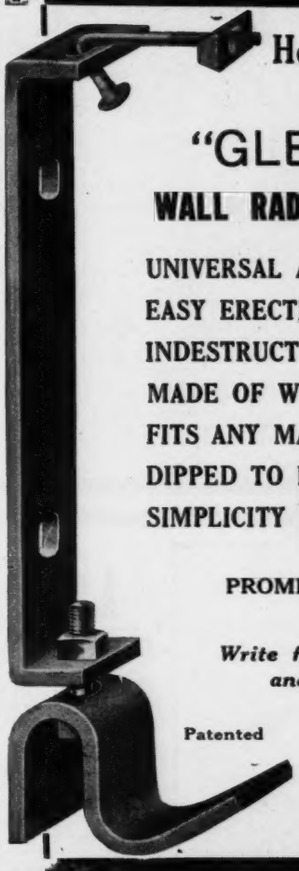

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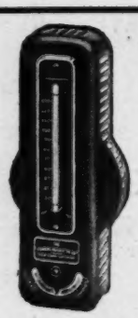

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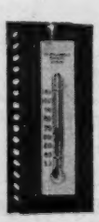

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~for Vapor heat control

Half page, The Saturday Evening Post, April 22nd issue

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